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Vol. III

TRANSCRIPT OF RECORD

Supreme Court of the United States

OCTOBER TERM, 1930

No. 51

SARANAC AUTOMATIC MACHINE CORPORATION,
PETITIONER,

vs.

WIREBOUNDS PATENTS COMPANY ET AL.

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE SIXTH CIRCUIT

PETITION FOR CERTIORARI FILED FEBRUARY 20, 1930

CERTIORARI GRANTED APRIL 21, 1930

(34,806)

(34,806)

SUPREME COURT OF THE UNITED STATES

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VOL. III

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63. A machine for making box blanks comprising, in combination, work-controlling means to receive a plurality of pairs of cleats disposed substantially end to end and pertaining to non-adjacent sides of the intended box, constructed and arranged to space said pairs apart endwise a predetermined distance appropriate to dimensions of an intended intervening side of the box; and means to secure side material to and foldably connect said pairs of cleats.

64. A machine for making box blanks from box parts including side material foldable along substantially parallel corner lines to provide box sides, and box members to be secured in pairs to said side material between and disposed transversely of corner lines thereof and near the extremities of said corner lines,—comprising, in combination, positioning means to receive said members in pairs disposed substantially end to end, constructed and arranged to space one said pair from another, a predetermined distance, permitting said pairs to be foldably connected and folded into a predetermined relation in forming a box; and means foldably to connect said members so spaced.

65. A machine for making box blanks comprising, in combination, cleat-positioning apparatus for a plurality of cleats disposed substantially end to end, constructed and arranged to space said cleats apart endwise a predetermined distance to permit them to be foldably connected and folded into a predetermined relationship in forming a box; and means foldably to connect the cleats so spaced.

66. A machine for making box blanks from box parts including side material foldable along substantially parallel corner lines to provide box sides, and box members to be secured to said side material between and disposed transversely of corner lines thereof and near the extremities of said corner lines,—comprising, in combination, positioning means to receive said members disposed substantially end to end, constructed and arranged to space one said member for one box side from another for a non-adjacent box side a predetermined distance, permitting said pairs to be foldably connected and folded into a predetermined non-adjacent relation in forming a box; and means foldably to connect said members.

In testimony whereof we affix our signatures, in presence of two subscribing witnesses.

Richard G. Inwood, Perry C. Lavenberg.

Witnesses: George Oltsch, Grace M. Cole.

(Here follow side folios 1139-1142)

[fol. 1143] United States Patent Office

Richard G. Inwood and Perry C. Lavenberg, of South Bend, Indiana, Assignors, by Mesne Assignments to Wirebounds Patents Company, of Kittery, Maine, a Corporation of Maine.

Method of Making Boxes

1,128,252. Specification of Letters Patent. Patented Feb. 9, 1915.

Original application filed October 4, 1904, Serial No. 228,443. Divided and this application filed April 21, 1914. Serial No. 833,353.

To all whom it may concern:

Be it known that we, Richard G. Inwood and Perry C. Lavenberg, both citizens of the United States, and residents of South Bend, county of St. Joseph, State of Indiana, have invented an Improvement in Methods of Making Boxes, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to the manufacture of wirebound boxes and pertains more particularly to methods of making wirebound boxes, box blanks, or blank sections, by appropriately assembling and securing together box parts comprising side material in the form of a sheet or sheets or strips, separate or individual cleats, and fastening means such, for instance, as staples which may be driven astride of binding wires and through the side material into the cleats.

PLAINTIFFS' EXHIBIT NO. 3.

Inwood & Lavenberg Method Patent in Suit,
No. 1,128,252.

1140

R. G. INWOOD & P. C. LAVENBERG.

METHOD OF MAKING BOXES.

APPLICATION FILED APR. 21, 1914.

1,128,252.

Patented Feb. 9, 1915.

2 SHEETS-SHEET 1.

Fig. 4.

Fig. 1.

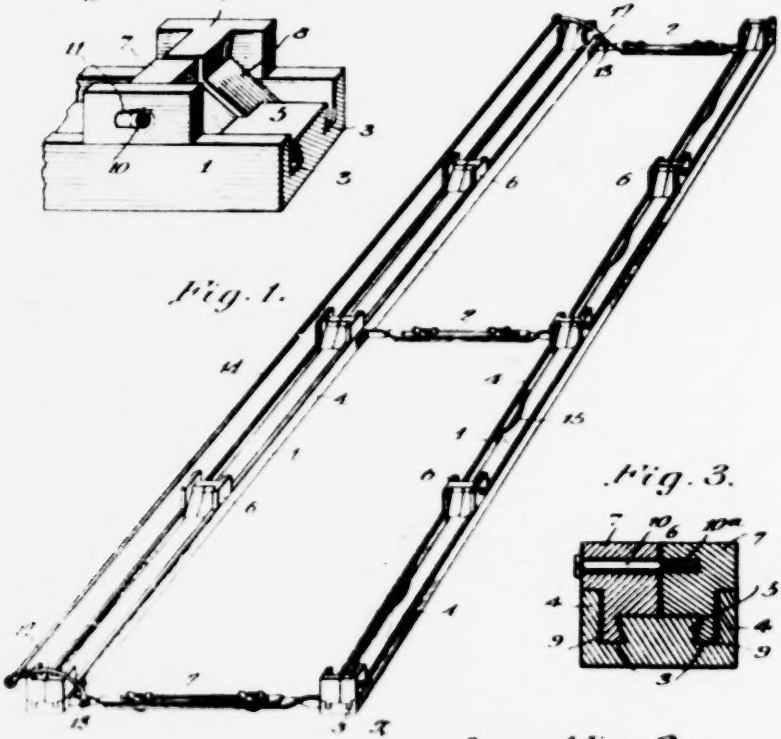
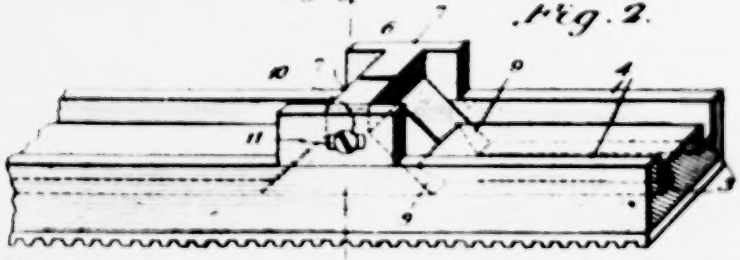


Fig. 3.

Fig. 2.



Witnesses:
Charlotte Berger
Carl L. Choate

Inventors
Richard G. Inwood,
Percy C. Lavenberg,
by Cooley, Crosby, Gannett & Hamilton
Attys.

1141-1142

R. G. INWOOD & P. C. LAVENBERG.

METHOD OF MAKING BOXES.

APPLICATION FILED APR. 21, 1914.

1,128,252.

Patented Feb. 9, 1915.

2 SHEETS—SHEET 2

Fig. 5.

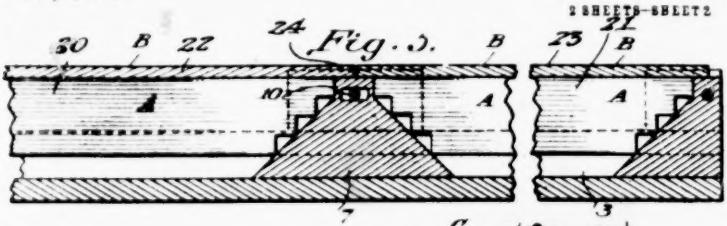


Fig. 6.

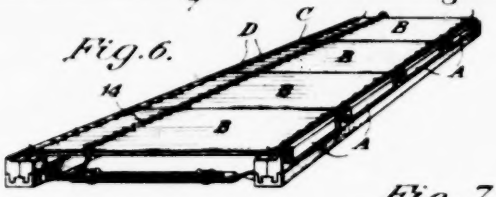
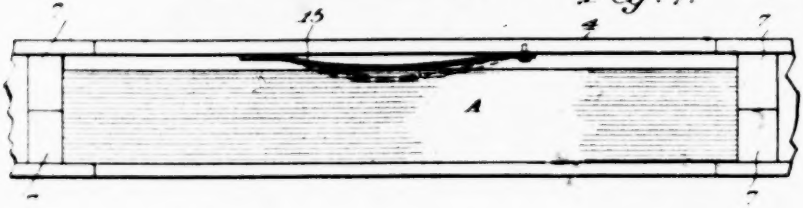


Fig. 7.



Witnesses:
Charlotte Birge
Earl L. Shorb

Inventors
Richard G. Inwood.
Percy C. Lavenberg.
by Emery, Booth, Janney & Varney
Attys.

The present application is a division of our copending application Serial No. 228,443, filed Oct. 4, 1904; and the method invention defined in the claims appended hereto may be conveniently explained by reference to the illustrative work-controlling means disclosed in said copending application as a so-called "combined carriage and former" suitable for use in making wirebound boxes.

One of the objects of the invention is to provide for a convient method of assembling and securing together box parts, which is readily applicable to commercial practices on a large scale employing relatively unskilled labor. By employing a method embodying the invention of a box-maker is enabled to practice a great many substantial economies which will appear to those skilled in the art.

In the accompanying drawings: Figure 1 is a perspective view of the combined carrier and former; Fig. 2 is an enlarged perspective view, showing a portion of the channeled bar and adjustable spacing block slidably mounted thereon; Fig. 3 is a transverse section on the line *x—x* of Fig. 2, showing the channeled bar, the divided spacing block and means for clamping the latter to the bar; Fig. 4 is a perspective view of the bar and spacing block mounted thereon, showing the adjustment of the separate block members relative to each other, so as to increase or decrease the intervening space between cleat ends as they are assembled on the carriage; Fig. 5 shows a longitudinal sectional detail of one of the bars comprising the carriage, with cleats positioned thereon and spaced apart the desired distance by the adjustable spacing blocks; Fig. 6 is a perspective view showing the members comprising the box blanks assembled and positioned on the carriage and means for holding the sheets against displacement upon the cleats; Fig. 7 is a fragmentary plan view of a cleat bar showing a cleat in position between the spacing block and means for holding the cleat firm in the cleat bar.

The combined carriage and former preferably comprises two longitudinal places or bars 1, which are connected and firmly held together parallel with each other, and at a distance apart corresponding to the length of the box sheets, or boards, by lengthwise adjustable cross bars 2, which are centrally slotted and held together by clamping thumb screws, allowing the bars 1 to be adjusted so as to increase

or decrease the width of the carriage. The longitudinal bars or plates are provided with dovetailed grooves 3, and side flanges 4, extending above the face of the bed plate 5, upon which the box cleats are positioned, the flanges 4 preventing lateral displacement thereof. To prevent end wise displacement of the cleats and to space the cleat ends an equal distance apart relative to each other, so that the ends will coincide and miter perfectly when the completed box blank is folded, we employ a spacing block 6 comprising two members 7, having diagonal or inclined integral face portions 8, which terminate on their lower outer ends in approximately V-shaped extensions 9, 9 conforming with and meshing with the dovetail grooves 3, of the bars 1, thus preventing vertical displacement of said spacing blocks but allowing a sliding engagement therewith, so that the blocks may be adjusted relative to each other for different lengths of cleats. The block members 7, when adjusted, are locked against displacement by clamping screws 10, which draw the parts together and clamp the members 9 to the bed place 5, the said members normally sliding freely [fol. 1144] in said bed plate when not clamped thereto.

In the manufacture of box blanks of the type for which the carriage and former is intended to be used, it is necessary that the cleats be relatively positioned in cooperative foldable relationship, so that in folding the blanks after the box members are stapled together preparatory to fastening box ends thereto, the mitered or step mitered ends will mesh perfectly. In one desired cooperative foldable relationship between one box section and the next, as illustrated in Fig. 5, the interval between adjacent cleat ends appropriate to the mutual engagement of the parts when folded, may depend upon the thickness of the side material for the box, the greater the thickness of such side material the greater the corresponding space provided between the cleat ends. To allow for this variation in the manufacture of different strength boxes which requires corresponding variations in the thickness of sheets, one member of each spacing block is provided with a slot 11, through which the clamping screw 10 projects, the extremity 10' of said screw only being screw threaded and engages with a screw threaded tap in the adjoining member of the spacing block. It will thus be seen that one member may be adjusted rela-

tive to the other (see Fig. 4) so that the space between the cleats will be increased or decreased as may be required.

In order to hold the sheets against displacement upon the cleats as the carriage is passed through the stapling machines, two arms 12 are pivoted respectively to the end cross bars 2 at 13, and their free ends connected by a rod 14, which is swung over on to the sheets and rests thereon, the weight of the rod holding them against displacement (see Fig 6). As shown in Figs. 1 and 6, the arms 12 are pivoted to rock substantially in the planes of the adjacent edges of the side sheets B and consequently, as will appear to those skilled in the art, one or both said arms will serve as a stop or stops to position the side-sheet material in relation to the carriage and the cleats held by the spacers 6. Since the sheets, as shown in Fig 5, may abut at their edges, the arms 12 may serve to hold all the sheets properly positioned.

In practice the spacing blocks are adjusted on the cleat bars so as to conform to the width of the box to be manufactured, the length of the cleats determining the width of the box sides. This being accomplished the cleats A are positioned on the bars between the spacing blocks and the sheets B placed thereon so that the edges join after which the retaining bar 14 is swung over so as to rest on the sheets, and hold them against displacement. This accomplished, the carrier with its assembled box parts is passed through a stapling machine and the sheets stapled to the cleats over a stay or reinforcing wire, which holds the sections together when the blank is removed from the former. Fig. 6 also shows the stay wires C and the staples D which straddle said wires. When the carriage is withdrawn from the machine and the completed box blank is removed therefrom, the same operation is repeated.

It is obvious that several carriages may be used for feeding the blanks to a single stapling machine. In order to hold the cleats firmly in the channels and against the outer flange of the cleat bar, so that the cleats will register with the edges of the sheets, and to prevent wobbling of the cleats and possible displacement, we provide plate springs 15, which are secured at one end of the inner flange of the bar, and their free ends having a constructive engagement

with said bar, the spring normally being distended or bulged in toward the center of the bar, as shown in dotted lines Fig. 7. The spring being depressed as the cleat is inserted as indicated by full lines, thus firmly binding the cleat in position on the bar.

Prior to the invention of the present method it had been the practice, in making wirebound boxes, to employ side material with long cleat strips which were first stapled to the binding wire and side material and then subsequently severed by step mitering the cleat strips at the points intended for the box corners. This practice necessitated the use of substantial lengths of high grade cleat material. It is one of the advantages of this invention, however, that small pieces of waste material may be used for the cleats which may be completely finished in the form which they are to have in the completed box and may be then suitably assembled and secured together with the side material and other cleats. Similarly, a preferred form of product which may be made by a method embodying this invention, may comprise separate previously formed side sheet sections, each for an individual box side, and composed of one or more strips or sheets of the side material.

It is deemed unnecessary to show or to describe herein any stapling machine to cooperate with the illustrative work-controlling means of the present drawings; a suitable machine for such purpose is shown in our co-pending application Serial No. 230,249, filed Oct. 27, 1904.

From the foregoing description it will be understood that one practicable method embodying the features of this invention comprises the preparation of individual side sheets and individual cleats in desired number and in substantially finished form, before assembling in the form of a blank or box; and after such preliminary preparation of parts, assembling them in desired spaced relation to suit [fol. 1145] the requirements of the finished box; and securing the side units of the blank or box together by means of a binder which, when completed, extends wholly around the finished box, so as to constitute a reinforcing and strengthening belt encircling the finished article.

A desired spaced relation of the parts is well exemplified by the illustrative construction shown in enlarged detail in Fig. 5. In Fig. 5, the cleats 20, 21, and side sheets

22, 23, are shown at an intended box corner. The specific cleats there shown for illustration are step-mitered. It will be noted that a cleat 20 and its connected sheet 22 are so disposed that the end of the cleat is spaced more or less from the edge of said sheet—that margin 24 of the sheet between the end of the cleat and the extreme edge of the sheet providing what may be termed an "overlap margin" adapted to overlap the edge of the next adjacent sheet. The illustrative method hereinbefore described in connection with the mechanical former, provides (as exemplified by the spacer blocks for the cleats) for one species of overlap margin, as shown in Fig. 5; and preferably such a relative arrangement of cleats and side sheets provides an overlap margin for each corner of the box, the result being tight closures at the corners in which the meeting edges of the side sheets, though separate, mate desirably. These meeting side edges are preferably not connected to each other in any manner except by the cleats and the binding wires. As indicated in Fig. 5, the sheets 22, 23 may have their edges close together; and when the parts are desired to be folded into box form the side sheet 23 may be pressed downwardly to engage its edge under the overlap margin 24, and then said side unit 23 may be rocked into a position perpendicular to the side unit 22. Obviously, with the illustrative spacing indicated in Fig. 5, this folding may have the effect of tensioning the wire over the box corner, as by forcing the wire to press or cut into the corner of the side sheet 22; and thus the wire may be placed under substantial tension to hold it tight and to hold the parts of the box in a tightly closed overlapping relation.

When the separate side units described above, are assembled with each other and connected by wire, the connection between the side units is readily flexible, permitting them to be adjusted and folded into box form with the corner parts in proper engagement, very expeditiously and without requiring any substantial skill in the adjustment.

One preferred form of box made by a method embodying this invention has each side sheet and unit separate from the adjacent side sheets and units; the meeting edges of two sheets merely overlap and are preferably not connected in any way save by the flexible binding wires and by such in-

terengagement as the cleats may have. Hence, when a strain in a diagonal direction is brought to bear upon the box, tending to distort it by crushing one corner toward the diagonally opposite corner, there is a tendency for certain of the side sheets to move lengthwise in relation to other adjacent side sheets, but no strain is transmitted directly from one such side sheet to another. On the contrary, the transmission of strains is performed almost entirely by the wires. In other words, the strains at the box corner edges—the points at which the strains tend to be the most destructive—are resisted by the tensile strengths of the wires themselves, while the meeting edges of the side sheets merely tend to slide upon each other without mutual strain. The wires being universally flexible laterally and being fastened to the sides preferably remote from the edges, they are free to be bent in the vicinity of the meeting side edges as the latter adjust themselves under strain, and therefore the wires are automatically adjusted to resist these strains by their tensile strength. The same advantage in the sliding relation of the meeting side edges at the corners of the box is also derived when a side sheet is made in two or more parts or when two or more sheets are used on a single side; that is to say, when two or more sheets on a single side are strained with the tendency to move relatively at their meeting edges, they are permitted to do so without requiring the wood to sustain the strain which is, in fact, resisted by the tensile strength of the wires.

Obviously, when the wires are secured to the side sheets by staples or other equivalent means, ordinarily there remains some capacity of the wires, under heavy pulls, to slip or creep in relation to the staples or other fastening devices. A heavy strain to the box—distorting it and causing the described relative movement of the meeting edges of side sheets—may cause the wire to slip somewhat in relation to the fastening devices and sides so that the strain applied to a wire at one point is transmitted throughout a considerable length of the wire, and is not applied to the box sides except by the frictional grip between the staples and wires which, in many instances, will slip before the sides will split or break.

For the reasons explained, the rigidity and ultimate strength of the box, especially against diagonal strains, de-

pends very largely upon the tensile strength of the binding wires which, being freely flexible, automatically adjust themselves to resist strains which tend to distort the box, and to transmit those strains along the length of the wire, [fol. 1146] to a considerable and important extent independently of any resistance by the box sides themselves. Obviously, a method which can produce a product of this character, admits of the use of a cheap and light-weight material to which the necessary strength and rigidity are most effectively added by the described mode of application of the wire binding. In other words, a method embodying this invention provides, in a manner excellently adapted to commercial practices, for the use of the cheap wire with thin cheap wood or other box material, whereby the cheap wire is a most efficient substitute for the expensive excess thickness of wood which would otherwise be required. The availability of the tensile strength of the wire provided for by this invention, adds to a box such great strength as could not be procured by other method except by the use of an excess thickness of stock costing many times the cost of wire.

Other advantages resulting from the described method, in addition to those pointed out above for illustration, will appear to those skilled in the art.

Obviously, this invention is not limited to the specific details of procedure described above for ilustration, nor is it limited in its application to any particular mechanical contrivances, although a method embodying the invention is especially well adapted to be practised by means of machinery. It is to be understood, further, that it is not indispensable that all the features of the invention be employed in a single method, since the features may be used to advantage separately as defined in the subjoined claims.

Claims:

1. The method of making wirebound boxes having individual cleats and individual side pieces separated at the lateral corner edges of the completed box and connected by wires at said edges, which comprises assembling a pair of previously formed individual cleats with separate previously formed side material for an individual side to provide a side unit of the box; assembling additional such side units to provide the other sides of the box; securing to the

cleats of each side unit a wire binding extending completely across said unit; connecting said side units by said wire binding, while leaving the latter laterally flexible to accommodate relative longitudinal shifting of the separate meeting edges of the side units; arranging said side units in box form; providing them with end closures; and completing the continuity of the wire binding; whereby relative longitudinal shifting of any or all the meeting edges of the side units tends to bend the wire binding out of normal alinement, and is resisted by the tensile strength of the wire.

2. The method of making wirebound boxes having individual cleats and individual side pieces separated at the lateral corner edges of the completed box and connected by wires at said edges, which comprises assembling previously formed individual cleats with the separate previously formed side material for an individual side to provide a side unit of the box; assembling additional such side units to provide the other sides of the box; securing to the cleats of each side unit a wire binding extending completely across said unit; connecting said side units by said wire binding, while leaving the latter laterally flexible to accommodate relative shifting of the separate meeting edges of the pieces of side material; arranging said side units in box form; and completing the continuity of the wire binding; whereby relative longitudinal shifting of meeting edges of pieces of side material tends to bend the wirebinding out of normal alinement, and is resisted by the tensile strength of the wire.

3. The method of making wirebound boxes having individual cleats and individual side pieces separated at the lateral corner edges of the completed box and connected by wires at said edges, which comprises assembling previously formed individual cleats with separate previously formed side material for an individual side to provide a side unit of the box; assembling additional such side units to provide the other sides of the box; securing to each side unit a wire binding extending completely across said unit; connecting said side units by said wire binding, while leaving the latter laterally flexible to accommodate relative shifting of the separate meeting edges of the side units; arranging said side units in box form; and completing the continuity

of the wire binding; whereby relative longitudinal shifting of any or all the meeting edges of the side units tends to bend the wirebinding out of normal alinement, and is resisted by the tensile strength of the wire.

4. The method of making wirebound boxes having individual cleats and individual side pieces separated at the lateral corner edges of the completed box and connected by wires at said edges, which comprises assembling previously formed individual cleats with separate previously formed side material for an individual side, to provide a side unit of the box; assembling additional side units to provide the other sides of the box; securing to each said side unit wirebinding extending completely across said unit, while leaving said wirebinding free from attachment to the side unit proximate the lateral edges thereof; connecting said side units by said wirebinding while leaving the latter laterally flexible to be bent at the edges of the side units upon relative longitudinal shifting of the separate meeting edges [fol 1147] thereof; arranging said side units in box form; and completing the continuity of the wirebinding; whereby relative longitudinal shifting of any or all the meeting edges of the side units tends to bend the wirebinding out of normal alinement, and is resisted by the tensile strength of the wire.

5. The method of making wirebound boxes having individual cleats and individual side pieces separated at the lateral corner edges of the completed box and connected by wires at said edges, which comprises assembling previously formed individual cleats with separate previously formed side material for an individual side, to provide a side unit of the box; assembling additional such side units to provide the other sides of the box; securing to each side unit a wirebinding extending completely across said unit; positioning the edges of the side units close enough together to tension the wires when said units are folded in box form; and leaving the wire connections laterally flexible to accommodate relative shifting of the separate meeting edges of the side units; arranging said side units in box form; and completing the continuity of the wirebinding; whereby relative longitudinal shifting of any or all the meeting edges of the side units tends to bend the wirebinding out of normal alinement, and is resisted by the tensile strength of the wire.

6. The method of making wire-bound boxes having individual cleats and individual side pieces separated at the lateral corner edges of the completed box and connected by wires at said edges, which comprises assembling previously formed individual cleats with separate previously formed side material for an individual side unit, a cleat end being spaced from an extreme edge of the side material to leave an overlap margin on said side material to mate with a corresponding portion of another side unit; assembling additional such side units with cleats and side material so spaced to provide an overlap margin at each corner edge of the box; securing to each said side unit so formed wirebinding extending completely across said unit; connecting said units by said wirebinding and leaving the latter laterally flexible to accommodate relative shifting of the separate meeting edges of pieces of side material; arranging said side units in box form; and completing the continuity of the wirebinding, whereby relative longitudinal shifting of meeting edges of pieces of side material tends to bend the wirebinding out of normal alinement, and is resisted by the tensile strength of the wire.

7. The method of making wirebound boxes having individual cleats and individual side pieces separated at the lateral corner edges of the completed box and connected by wires at said edges, which comprises assembling previously formed individual cleats with separate previously formed side material for an individual side to provide a side unit of the box; assembling additional such side units to provide other sides of the box, securing to each said side unit a wirebinding extending completely across said unit; connecting said units by said wirebinding while leaving the side units otherwise wholly disconnected and separate; arranging said side units in box form; and completing the continuity of the wirebinding, to complete the connections of the side units while leaving said side units wholly disconnected at all lateral corner edges of the box except by the wires and cleats, whereby relative longitudinal shifting of any or all the meeting edges of the side units tends to bend the wirebinding out of normal alinement, and is resisted by the tensile strength of the wire.

8. The method of making wirebound boxes having individual cleats and individual side pieces separated at the

lateral corner edges of the completed box and connected by wires at said edges, which comprise assembling previously formed individual cleats with separate previously formed side material for an individual side to provide a side unit of the box; assembling additional such side units to provide the other sides of the box; securing to each said side unit a wirebinding extending completely across said unit and fastened thereto frictionally by straddling fasteners; connecting said units by said wire binding while leaving the latter laterally flexible to accommodate relative shifting of the separate meeting edges of pieces of side material; arranging said side units in box form; and completing the continuity of the wirebinding to encircle the box by the binding frictionally secured to the side units thereof; whereby relative longitudinal shifting of meeting edges of pieces of side material tends to bend the wirebinding out of normal alinement, and resisted by the tensile strength of the wire which is permitted a sufficient capacity to creep under its frictional fastenings to transmit the longitudinal strains along substantial lengths of wire.

9. A method of making box blanks which comprises assembling a plurality of box sections in cooperative foldable relationship; and foldably connecting said sections in said relationship by wires extending across the respective sections to substantial distances from the corner line and secured against substantial lateral displacement on the sections within said distances, and leaving said side sections otherwise substantially disconnected to permit relative longitudinal shifting of meeting edges of the said sections and bending of the wire to resist such shifting by its tensile strength.

10. A method of making box blanks which comprises [fol. 1148] assembling in cooperative foldable relationship a series of box sections each comprising individual cleats and side material; and securing a substantially continuous length of wire along the respective series of cleats for foldably connecting the sections in succession.

11. A method of making box blanks which comprises assembling a plurality of cleats substantially end to end with with the adjacent cleat ends in coöperative foldable relationship; and securing side material and binding wires

to the cleats so assembled to connect foldably the adjacent cleat ends, the side material having been previously prepared to facilitate folding along the lines of the intended box corners proximate the cleat ends.

12. A method of making box blanks which comprises assembling in cooperative foldable relationship, a plurality of box sections having their edges close enough together to tension the wires and cause them to tend to cut into the edges of the sections when said sections are folded in box form; and foldably connecting said sections in said relationship by wires extending across the respective sections to substantial distances from the corner and secured to the sections against substantial lateral displacement within said distances.

13. A method of making box blanks which comprises assembling in cooperative foldable relationship a series of box sections with their edges close enough together to tension the connecting wires and cause them to tend to cut into the edges of said sections when folded; and foldably connecting, by wire, said sections in said relationship.

14. A method of making box blanks which comprises assembling groups of box parts, said groups including box parts for non adjacent sides of the intended box positioned apart a distance appropriate to the dimensions of the box between said non adjacent sides; and foldably connecting said groups by wires extending over the space between the groups.

15. A method of making box blanks which comprises assembling groups of box parts, said groups including box parts for oppositely disposed sides of the intended box, and each said group comprising members to be located near the ends of and extending transversely of the intended box sides; positioning said groups with said members disposed substantially in line with the groups for opposite sides a distance apart appropriate to the dimensions of the box between said oppositely disposed sides; and foldably connecting said groups by wires secured thereto and extending over the spaces therebetween.

16. A method of making box blanks which comprises assembling and foldably connecting by wire extending across from groups of box parts to form two or more sides

PLAINTIFFS EXHIPIT NO 4

Inwood & Lavenberg Box Reissue Patent No 12,725

No. 12,725. REISSUED NOV. 26, 1907.

R. G. INWOOD & P. C. LAVENBERG.

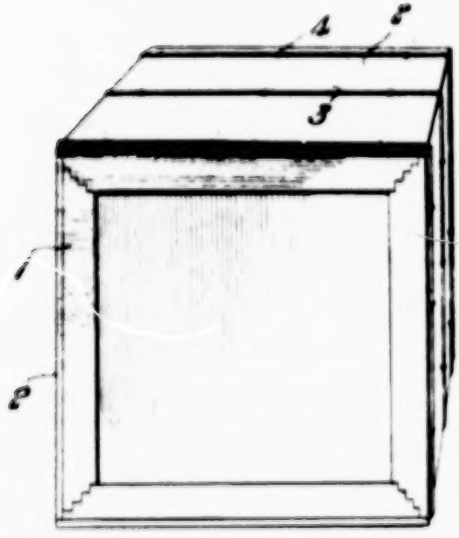
BOX.

APPLICATION FILED JUNE 19, 1907.

2 SHEETS—SHEET 1.

Fig. 1.

Fig. 2.



Witnesses:
Chas. E. Coy Jr.
Chas. H. Burell.

Inventors:
Richard A. Inwood
Percy C. Lavenberg.
By Dyrenforth, Lee, Chritton & Wallace,
Attys.

No. 12,725. REISSUED NOV. 26, 1907.

R. G. INWOOD & P. C. LAVENBERG.

BOX.

APPLICATION FILED JUNE 13, 1907.

2 SHEETS—SHEET 2.

Fig. 3.

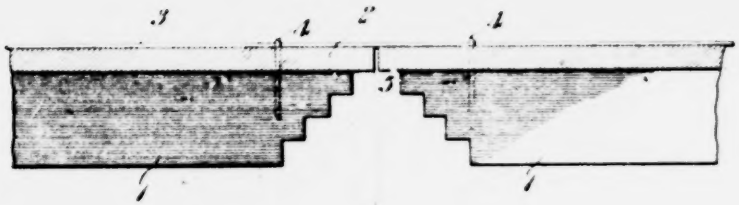
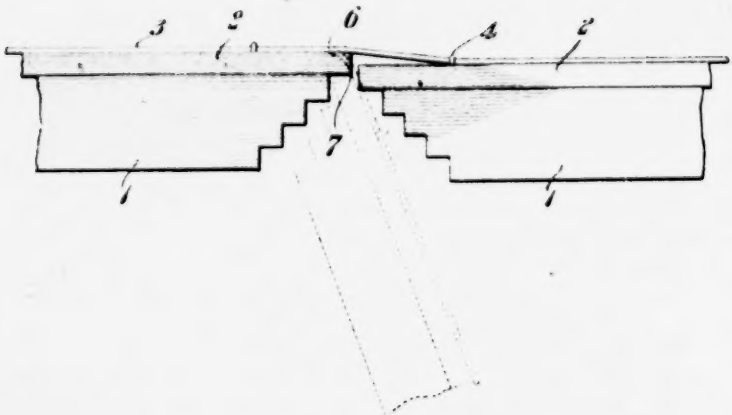


Fig. 4.



Witnesses:
Earl C. Gaylord.
Chas. H. Buell.

Inventors:
Richard G. Inwood &
Perry C. Lavenberg,
By Dyrenforth, Lee, Chritton & Wiles,
Attys.

of a box, but including at least two sides so arranged as to be opposite each other when folded to form the box, and so folding said parts.

17. The method of making box blanks which comprises assembling with side material foldable along substantial parallel corner lines, box members to be secured to said side material between and disposed transversely of corner lines thereof and near the extremities of said corner lines, said members for respective sides being spaced endwise one from another a predetermined relation in forming a box; and foldably connecting said members by wires extending along said members and secured thereto and to the side material permitting the side material, said members and the wires to be folded together.

In testimony whereof, we have signed our names to this specification, each in the presence of two subscribing witnesses.

Richard G. Inwood, Perry C. Lavenberg.

Witnesses: Samuel M. Robinson, Ethel Frye.

(Here follow side folios 1149-1152)

[fols. 1153 & 1154] United States Patent Office

Richard G. Inwood and Perry C. Lavenberg, of South Bend, Indiana, assignors to the National Wire Bound Box Company, of South Bend, Indiana, a corporation of Indiana.

Box

No. 12,725. Specification of Reissued Letters Patent. Reissued Nov. 26, 1907

Original No. 799,854, dated September 19, 1905, Serial No. 228,765. Application for reissue filed June 13, 1907. Serial No. 378,881

To all whom it may concern:

Be it known that we, Richard G. Inwood and Perry C. Lavenberg, both citizens of the United States, residing at South Bend, in the county of St. Joseph and State of In-

diana, have invented a new and useful Improvement in Boxes, of which the following is a specification.

Our invention relates to certain improvements in wire bound boxes, especially of that class in which the blanks constituting the four sides of the box are assembled and secured in relative position to each other prior to folding by reinforcing wires, and has for its object the assembling and fastening together such parts constituting the completed blank so that the same when folded will produce overlapping edges of the side sheets or boards, the advantages of which will be hereafter pointed out.

Referring to the drawings: Figure 1 shows a complete box blank which forms the four sides of a box when folded. Fig. 2 is a perspective view of the blank when folded showing the sides thereof overlapping and box end in place. Fig. 3 shows two enlarged sections of the blank the full lines before folding and the dotted lines a section folded at right angles to the other in making a joint, the full lines also showing the spacing of the cleats and sheets with relation to each other. Fig. 4 shows an enlarged fragmental view of two sections, and the radius of movement relative to each other at different stages in the action of folding.

In the drawings 1 are the cleats which are step-mitered at their ends.

2 are the box sides or sheets which are disposed upon the cleats, and 3 are reinforcing wires which are positioned coincident with the cleats and staples 4 driven straddling of said wires through the sheets into the cleats, the reinforcing wires thereby also serving to hinge the four sections comprising the completed blank together.

The ends of the cleats 1 are spaced a distance apart measured from the adjoining edges of the sheets, equal to the thickness of such sheets, as at 5 so when the blank is folded to form the four sides of a box, the sheets will overlap, and form a square cornered box, as shown in Fig. 2.

It may appear from the drawing that difficulty would be experienced in folding the sections owing to the edges of the sheets abutting, and the same being held in that relative position and against movement away from each other by the reinforcing wires. It is found in practice, however, the sheets being of soft wood veneering, that in folding over one section on the other, the reinforcing wire will cut

into the sharp edges of the sheets, as shown at 6 in Fig. 4, and the end of one sheet will crush the inner edge of the adjoining sheet sufficiently, as at 7 Fig. 4, so as to allow same to pass each other, and fold over so as to form overlapping edges or joints.

The present method of manufacturing wire-bound boxes is to form the blank of a single sheet stitched or stapled to single piece cleats for each end of the box, the cleats being stepmitered and the sheets scored or grooved on the under side, so as to form four sections, after the cleats, sheets and reinforcing wires have been stapled together. This box blank when folded forms a rounding edge, the veneer sheets if not thoroughly seasoned so as to have pliability, begin to check as the lumber seasons. As the grain of the wood may be diagonal to the edge of the box the check will follow the grain, thus rendering the box unsightly, besides a possible opening of a size so as to preclude its use for goods requiring a tight jointed box.

We claim as our invention, and desire to secure by Letters Patent

1. A wire-bound foldable box-blank, comprising a plurality of straight-edged sheets, wires secured to and connecting said sheets, and cleats secured to said sheets to terminate short of edges of the latter a distance equal or approximately equal to the thickness of a sheet, whereby when folded at a right-angle the end of one sheet overlaps the end of an adjacent sheet.

2. A wire-bound foldable box-blank, comprising a plurality of straight edged sheets, wires secured to and connecting said sheets, and step-mitered cleats secured to said sheets to terminate short of edges of the latter a distance equal to the thickness of a sheet, whereby when folded at a right angle the end of one sheet overlaps the end of an adjacent sheet.

Richard G. Inwood, P. C. Lavenberg.

Witnesses: Blanche Ressler, J. E. Whitehall.

(Here follow side folios 1155-1160.)

DEFENDANT'S EXHIBIT NO. 16.

VOLUME OF PRIOR ART PATENTS.

1157-1158

(No Model.) 2 Sheets—Sheet 1.

M. A. HAMILTON.

KNOCKDOWN BOX.

No. 373,828. Patented Nov. 29, 1887.

Fig. 1.

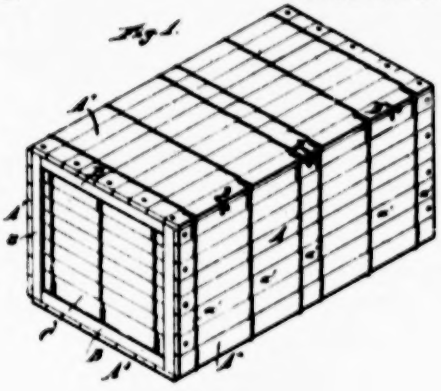


Fig. 2.

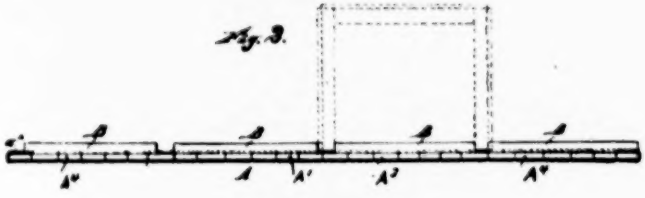


Fig. 3.

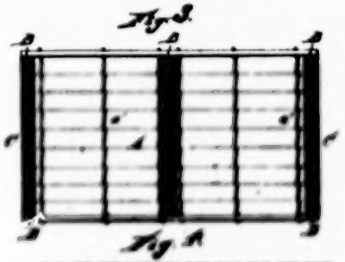
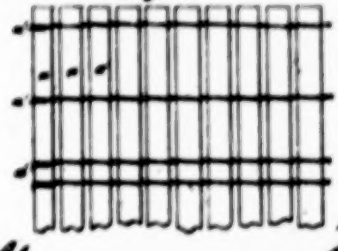


Fig. 4.



WITNESSES

John A. Wiles.

N. S. Wright

INVENTOR

Milton A. Hamilton

By Wiles & Coggeshall.

Attorneys

(No Model.) 2 Sheets—Sheet 2.

M. A. HAMILTON.

KNOCKDOWN BOX.

No. 373,628. Patented Nov. 29, 1887.

Fig. 5.

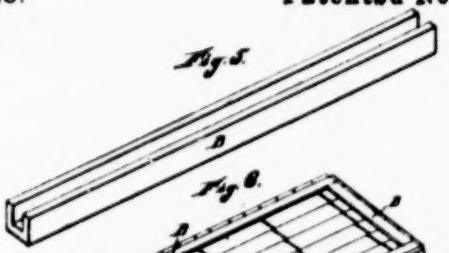



Fig. 6.

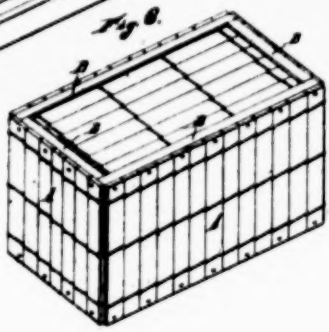


Fig. 7.

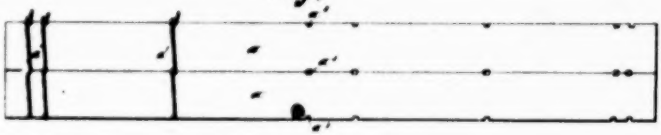
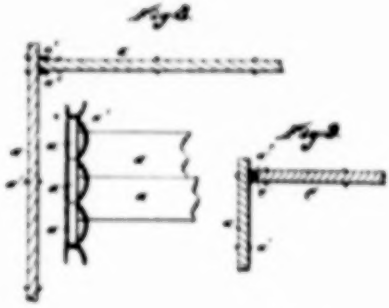


Fig. 8.



WITNESSES

INVENTOR

Milton A. Hamilton

By

[fol. 1161] United States Patent Office

Milton A. Hamilton, of Detroit, Michigan

Knockdown Box

Specification Forming Part of Letters Patent No. 373,828, Dated November 29, 1887

Application filed March 7, 1887. Serial No. 230,022. (No model.)

To all whom it may concern:

Be it known that I, Milton A. Hamilton, of Detroit, county of Wayne, State of Michigan, have invented a new and useful Improvement in Knockdown Boxes; and I declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawings, which form a part of this specification.

My invention has for its object the construction of a novel box for shipping and other purposes, constructed in whole or in part of a fabric formed of a series of slats interwoven with a series of wires, said box being readily reducible to a knocked down condition for transportation or storage; or for the return of the same to the shipper; and it consists of the combination of devices and appliances hereinafter specified, and more particularly pointed out in the claims.

In the drawings forming part of this specification, Figure 1 represents a closed box embodying my invention. Fig. 2 is an additional view of the same opened out into knocked-down condition. Fig. 3 is a cross section illustrating how the ends or partitions may be engaged with the sides of the box. Fig. 4 is a separate view of a portion of fabric entering into the construction of the box where ventilation is desired. Fig. 5 is a separate view of one of the channel-cleats. Fig. 6 illustrates a modification in which the slats constituting the sides extend perpendicular to the plane of the bottom. Fig. 7 is a separate view showing the slats notched on the edge to receive the wire. Fig. 8 is a separate view showing a croze channel of wire.

Fig. 9 is a modification showing a single wire engaging a head.

I carry out my invention as follows:

A represents the fabric entering into the construction of the box, said fabric constructed of a series of wooden slats, *a*, preferably laid side by side or edge to edge, said slats constituting the woof of the fabric, the warp consisting of a series of wires, *a'*. A fabric so constructed is strong, and, as will be seen, is readily flexed at any point without materially weakening the structure. This fabric I have found adapted in any convenient way in the construction of boxes for the shipment of fruits and other articles.

B represents channel cleats, which may be fastened at one end of a series of slats, said cleats adopted, when the fabric is folded, to engage in their respective channels analogous sections which may constitute the ends or intermediate partitions of the box. Thus the channel-cleats may be attached to the sides A' A^2, the bottom A^3 of the box, and to the cover A^4 of the case. The channel-cleats are constructed of separate pieces of wood grooved, as shown, to form a groove or croze to receive an edge of the end pieces or partition, said cleats being fastened in any suitable manner to the slats of which the fabric is composed—as, for instance, by tacks or nails. The channel-cleats are permanently engaged with the fabric and remain engaged therewith when the package is knocked down and are in place to engage the edges of the end pieces or partitions in making up a package. Two or more of these channel-cleats may be employed to engaged said end pieces or partitions. When so constructed, the channel of said cleats will obviously inclose the four edges of the ends C when the box is closed. These ends may be constructed of the foregoing fabric or they may be of one or more pieces of boards, while the remaining four sides of the box may be made of said fabric.

When it is designed to provide the box with a partition, additional channel-cleats may be provided and suitably engaged to embrace the ends of said partitions, the partitions themselves either being made of the fabric or of boards, as may be preferred. When the front, rear, and bottom have thus been brought into position to embrace the edges of said ends within the channel of said cleats,

they may be fastened in such position by brads or tacks or by wire—as, for instance, at the corners.

It is obvious that the lid may be closed down upon the upper edges of the ends in an analogous manner, in which position it may be fastened securely by wires D, as shown in Fig. 1. When this fastening is undone, the lid may be opened, the wire of the fabric serving the purpose of a hinge—*i. e.*, permitting the cover to flex at the division-line between it and the side.

[fol. 1162] It will furthermore be seen that the front, bottom, rear, and top may be made of an integral piece of fabric. The lid may be thus engaged upon one of the four sides of the box, as may be preferred, without any alteration in the usual construction.

It is evident that a box so made is neat and inexpensive. Not only may it readily be knocked down, as above described, but it may with equal facility be made up again into a complete box for use. When knocked down it is in a very compact shape, occupying very little room. No nails are used in the ordinary manner, a few brads or tacks sufficing all purposes. When the channels have once been engaged with the fabric, as already set forth, no further tacks, brads, or nails are required in assembling the parts for use, except possibly at the corners. A box so constructed may be used again and again without injury.

I prefer to make the fabric of ordinary lath, either plain or rough, with the wires with which it is interwoven.

It will be evident that should any single slat become broken it will not materially injure the safety of the package.

A box so constructed is very much lighter than a box constructed in the ordinary manner, while it possesses all the necessary strength possessed by ordinary board boxes made of much thicker material.

Instead of having the slats arranged in the manner shown in Fig. 1 of the drawings, the slats constituting the sides may be arranged to stand perpendicular to the bottom of the box.

When it is desired to make a tight box, a box so constructed as now described may be lined with any suitable fabric, a^2, as illustrated in Fig. 2.

When it is desired to bring the edges of the slats in close proximity where hard wood is employed, it may be desir-

able to provide the said slats upon the edges with notches a^3, as shown in Fig. 7, to receive the wire. Where soft wood is employed, the wire may be embedded in the wood sufficient to answer this purpose. When this fabric is employed in the construction of boxes or crates requiring ventilation, the slats may be interwoven with the wire, separated a desired distance from each other, as shown in Fig. 4.

For many purposes the fabric may be woven in such a manner as to have the wires at the sides or ends of the box or at intermediate points project out from the face of the slats upon the surface used for the inside of the box, as shown in Fig. 8 at a^5 and a^6, two lines of such projected wires forming a channel for the reception of the ends or other desired parts. When thus constructed, a few nails may be used at about the center of the sides to more firmly engaged the sides with the ends at these points. In such cases the channel-cleats, as shown in Fig. 2, may be dispensed with.

Instead of projecting two adjacent wires to form a croze-channel, as shown in Fig. 8, a single wire entering into the construction of the fabric may be projected from the face of the slats, as shown in Fig. 9 at a^7, the adjacent partition, end, or side, as the case may be, being recessed, as shown at e, to receive the projected wire and form the required engagement.

What I claim is—

1. A box in which the four sides are made of a fabric of slats interwoven with a warp of wires, having in combination therewith end pieces, said fabric provided with channel-cleats B, fastened to said slats for receiving the edges of said end pieces, respectively, substantially as described.

2. A box in which the sides and ends are made of fabric consisting of slats woven together with a warp of wire, said fabric provided with channel-cleats B, attached to said slats for receiving the edges of the end pieces, substantially as described.

3. A fabric for the construction of packages, consisting of wooden slats interwoven with a warp of wires and having in combination therewith separate channel-cleats B, permanently fastened to said slats, substantially as and for the purpose described.

4. A box in which the sides and ends are made of a fabric of slats interwoven with a warp of wires, said sides formed of a single integral piece of said fabric and provided with croze-channels adapted to engage said ends substantially as described.

5. A package in which the sides or sides and ends are formed of a fabric of wooden slats interwoven with a warp of wires, said slats notched upon their edges to receive said wires and bring the adjacent edges of the slots tight together, substantially as described.

6. A fabric for the construction of a box or package, consisting of wooden slats interwoven with a warp of wires, said slots notched upon their edges to receive said wires and bring the adjacent edges of the slats tight together, substantially as described.

7. A package consisting of wooden slats interwoven with a warp of wires, the wire of said fabric projected upon one of the faces at desired points, and having in combination therewith recessed ends or partitions engaging said projected wires, substantially as described.

In testimony whereof I signed this specification in the presence of two witnesses.

Milton A. Hamilton.

Witnesses: N. S. Wright, M. B. O'Dogherty.

(Here follow side folios 1163 and 1164.)

[fol. 1165] United States Patent Office

Benjamin Shunk, of Fernandina, Florida

Head for Fruit-boxes

Specification forming part of Letters Patent No. 410,034, dated August 27, 1889

Application filed April 24, 1889. Serial No. 308,452. (No model.)

To all whom it may concern:

Be it known that I, Benjamin Shunk, a citizen of the United States, and a resident of Fernandina, in the county

(No Model.)

B. SHUNK.

HEAD FOR FRUIT BOXES.

No. 410,034. Patented Aug. 27, 1889.

Fig. 1.

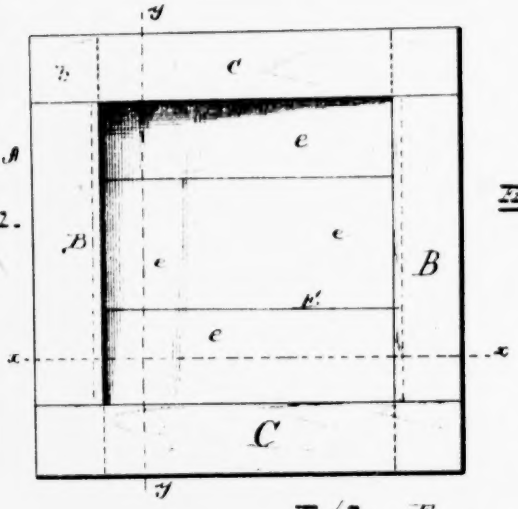


Fig. 4.

Fig. 2.

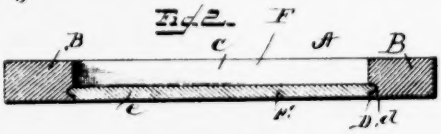


Fig. 3.

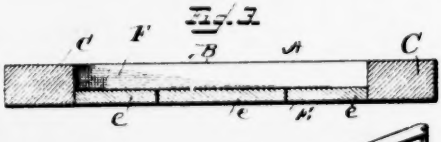


Fig. 6.

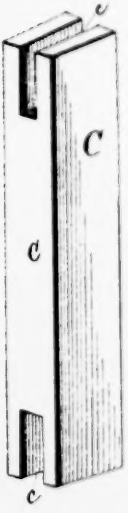


Fig. 5.

WITNESSES

F. L. Ourand

A. W. Christy

INVENTOR

Benjamin Shunk

by James Dagger & Co

Attorneys

of Nassau and State of Florida, have invented certain new and useful Improvements in Heads for Fruit and Vegetable Boxes; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to heads for fruit and vegetable boxes.

The principal object of my invention is to produce a box-head which may be constructed of small pieces of lumber that would ordinarily be wasted, while at the same time producing a durable and cheap head. A subsidiary object is to reduce the cost of manufacture, and thus save both time and money.

With these objects in view the invention resides, broadly, in a box-head consisting of a frame suitably mortised together and provided on its inner edges with grooves, in combination with slats or boards provided with rabbeted ends to fit in the said grooves.

Furthermore, the invention consists in the improved construction and combination of parts of a box-head, which will be hereinafter fully described in the specification, illustrated in the drawings, and more particularly pointed out in the claim.

In the accompanying drawings, forming part of this specification, and in which like letters of reference indicate corresponding parts, I have illustrated one form of head embodying the essential features of my invention, although the same may be carried into effect in other ways without in the least departing from the spirit thereof.

In the drawings, Figure 1 is a plan view of my improved box-head, showing the peculiar configuration. Fig. 2 is a cross-section taken on the line *x x* of Fig. 1. Fig. 3 is a similar view taken on the line *y y*. Fig. 4 is a detail view of one of the end pieces. Fig. 5 is a similar view of the filling-pieces, and Fig. 6 is a detail view of the other end piece.

Heretofore there has always been a large waste of lumber in the construction of boxes, inasmuch as the short pieces cut from boards have been wasted, in that they were too small to be used in the construction of a box for packing purposes. This has been found to be a great loss to manufacturers, and it is the object of this invention to utilize the short pieces in the construction of box-heads, and to so

construct the head that the nails used in securing the same to the box will also serve to hold various parts of the head together. In the particular use to which heads of this class are designed to be used—that is, in boxes used for packing oranges—this will be found highly useful and of great advantage.

By referring to the drawings it will be readily seen how I construct my improved head.

In the drawings, A designates a frame consisting of the end pieces B, provided with tenons *b*, and the end pieces C, provided with the open ended mortises *c*. The inner end of the edge of the end pieces B is provided with the rabbet D, which may be of any configuration—that is, angular, square, or U-shaped—and is, as will be seen, nearer the lower side of the frame than the upper.

E designates the filling, which may be constructed of a number of small pieces of lumber *e*, having their ends provided with the tenon *d*, adapted to fit in in the rabbet D. As will be observed, the tenon on the filling is on the side of the end instead of in the center, so that when placed in position, as shown in Fig. 3, the filling will be flush with the inner edge of the frame, which will be readily understood from the fact that the rabbet in the ends is on one side instead of in the center. Thus when the filling is placed in the frame the side which is intended to be next to the article in the box—that is, the inner side—will be a level surface, while the upper side will have shoulder F, which serves as a handhold for use in the handling of the box.

If desired, instead of only the ends being provided with a rabbet, the sides may also be rabbeted, thereby presenting a tight box-head. Should this particular kind of a head be used as a partition for dividing an orange-box into two parts, the filling will be of sufficient thickness to present a level surface on both sides, thereby preventing damage to the fruit, which would follow should the sharp edges of the shoulder F be left exposed. When this head is to be placed on the box, it is only necessary in order to clamp the device [fol. 1166] securely together to drive nails through each of the four corners, when the sides and ends will be securely clamped together against working loose.

It will be readily seen from the foregoing description that although this device is exceedingly simple of construction it will be found of the highest efficiency in use, in that all

(No Model.)

R. J. PATTERSON.

CRATE HEAD.

No. 441,326. Patented Nov. 25, 1890.

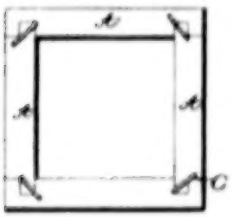


Fig. 1.

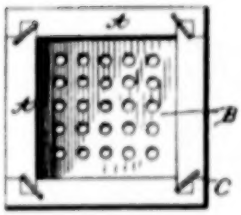


Fig. 2.

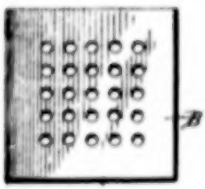


Fig. 3.

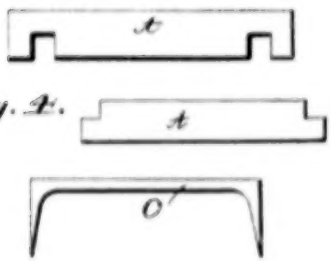


Fig. 4.

Fig. 6.

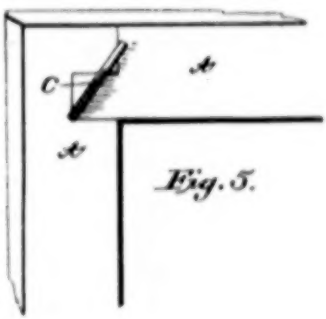


Fig. 5.

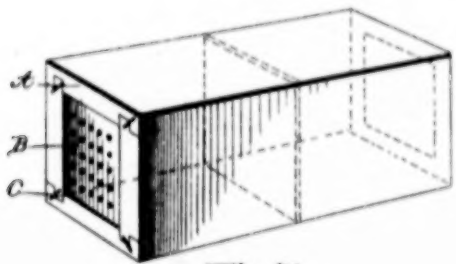


Fig. 7.

Witnesses.
Arthur Ashley
A. Lockhard

Inventor
Ralph J. Patterson, by
Thomas J. Johnston,
attorney.

waste lumber may be utilized in the construction of boxes, and that no nails are necessary to hold the frame together other than those used in securing the head to the box; moreover, that they may be constructed at a very slight expense.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent is,—

The box-head herein described and shown, consisting of the end pieces provided with tenons and a groove or rabbet in one side, the side pieces having mortises to receive the tenons of the end pieces, and the filling consisting of pieces fitted together and having their ends formed with tongues, providing tenons adapted to fit in the grooves or rabbets of the end pieces, substantially as shown and described.

In testimony that I claim the foregoing as my own I have hereunto affixed my signature in presence of two witnesses.

Benjamin Shunk.

Witnesses: Geo. W. Edwards, J. A. Edwards.

(Here follow side folios 1167 and 1168.)

[fol. 1169 & 1170] United States Patent Office.

Ralph J. Patterson, of Doctortown, Georgia.

Crate-head

Specification Forming Part of Letters Patent No. 441,326, Dated November 25, 1890

Application filed January 31, 1890. Serial No. 338,794. (No model.)

To all whom it may concern:

Be it known that I, Ralph J. Patterson, a citizen of the United States, residing at Doctortown, in the county of Wayne and State of Georgia, have invented certain new and useful Improvements in Crate-Heads, of which the following is a specification.

My invention relates to that class of heads used in crates for oranges or other fruits, and has for its object to provide a head which is easily and cheaply made, but which

will also make the crate stronger than the common construction, at the same time providing ventilation in the head, and not by leaving gaps between the shooks. This latter construction is faulty, leaving edges against which the fruit is cut and bruised in transportation and exposing it to other damage.

In the drawings hereto annexed, and made a part of this specification, Figure 1 shows the frame of the crate-head in elevation. Fig. 2 shows the head complete. Fig. 3 shows the perforated piece giving ventilation. Fig. 4 shows the pieces of frame, there being four of these pieces, two of each kind. Fig. 5 shows a joint of the head-frame. Fig. 6 shows the peculiar nail used to join the corners of the frame, and Fig 7 shows an isometric perspective of a box or crate embodying my invention.

The construction of my improved crate-head is as follows: The four pieces A A A A (fully shown in Fig. 4, using two of each of the kinds shown herein) are put together in the manner shown in Fig. 1, well known in the trade. These pieces are of one and one-fourth inch stuff, and when in place form a frame. The corners of the frame are further secured together by the staple-nail C, Fig. 6, having a rigid body and internal wedge-faces, acting to force together the corner mortises, it being evident, however, that in many cases a staple-nail of wire would be sufficiently strong. To the inside face of the frame thus formed is fastened the perforated piece of thin wood B, (shown in Fig. 3,) making the crate-head appears as in Fig. 2. The perforations are sufficient to ventilate the box thoroughly. Placing this piece on the inside of the frame gives there a flush surface avoiding contusion of the fruit, and also leaves a recessed end to the crate, whereby it is easily handled. Two heads being made, thin wood sides are nailed on in the usual manner to make a box. If a mid-head is used, it should have a perforated piece on each side of the frame, so as to present a smooth surface to the fruit.

Having thus described my invention, what I claim, and desire to protect by Letters Patent of the United States, is—

In a packing-box for fruit, a head-frame formed of the pieces A A A A, fastened together by a mortise and tenon

(No Model.)

J. HOWENSTINE.

FOLDING BOX.

No. 453,479. Patented June 2, 1891.

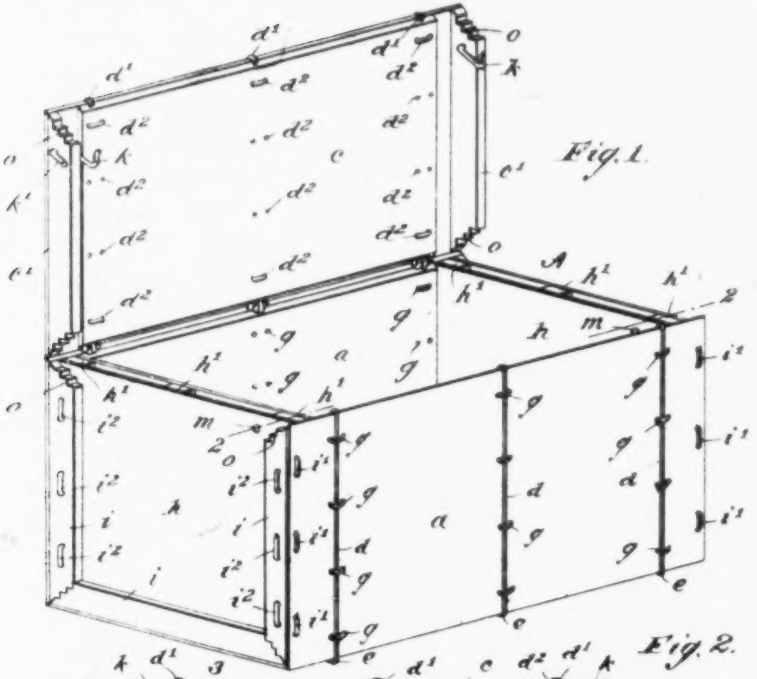


Fig. 1.

Fig. 2.

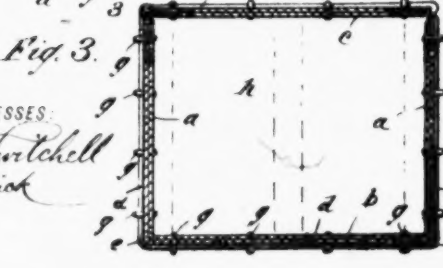


Fig. 3.

WITNESSES:

Wm. Turchell

to Sedgwick

INVENTOR:

J. Howenstine

BY Munn & Co

ATTORNEYS

and secured at its corners by the staple-nail C, having a rigid body and internal wedge-faces, in combination with the perforated piece B, secured to the inside of the frame, covering the opening therein, and securing its component members together, substantially as described.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

Ralph J. Patterson.

Witnesses: E. C. Fort, Henry R. Fort.

(Here follow side folios 1171 and 1172)

[fol. 1173] United States Patent Office

John Howenstine, of Fort Wayne, Indiana

Folding Box

Specification forming part of Letters Patent No. 453,479, dated June 2, 1891

Application filed August 27, 1890. Serial No. 363,218. (No Model.)

To all whom it may concern:

Be it known that I, John Howenstine, of Fort Wayne, in the county of Allen and State of Indiana, have invented a new and useful Improvement in the Manufacture of Boxes, of which the following is a full, clear, and exact description.

My invention relates to boxes, egg-cases, fruit-crates, and similar receptacles, and has for its object to produce strong, light, shapely, and cheap receptacles from any suitable material by a novel method of construction, whereby the sides, bottom, and top are stiffened and held connected, so that they may be erected into rectangular form or be extended in one plane as a knock down box; and to this end it consists in a box having its parts constructed and arranged as is hereinafter described, and indicated in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters

of reference indicate corresponding parts in all the figures.

Figure 1 is a perspective view of the box with its lid opened. Fig. 2 is a longitudinal sectional elevation of the box with the cover closed, taken on the line 2 2 in Fig. 1; and Fig. — is a transverse sectional elevation taken on the line 3 3 in Fig. 2.

The preferred form for the box A, as shown in the drawings, is rectangular; but other shapes may be given to the structure, if desired, and embody the features of my invention.

Any suitable material in thin plates, sheets, or slabs may be utilized for the formation of the improved box; but to secure stability, lightness, and facility in the manufacture at a minimum cost for production thin wooden sheets or boards are preferred.

To afford a light and strong structure, the sides *a* of the box are made of one or more thin pieces of board cut of proper and equal width and length, the grain of the material when two or more pieces are used being crossed at a right angle in these pieces, so that when they are united they will mutually stiffen each other and prevent warping of the material.

The bottom *b* and lid *c* of the box are each made one or more thicknesses of material, and when more than one piece is used these are disposed to cross the grain of the stuff in a manner similar to the construction of the sides *a*.

At evenly-spaced intervals on the outer surface of the sides *a*, bottom *b*, and lid *c* of the box A there are stiffening wire rods *d d* secured, which rods are made of a thickness proportional to the dimensions of the parts they are attached to. The ends of the stiffening-rods *d* are bent into hook form and are hooked upon the top edges of the sides *a*, said rod being made of such length as will permit them to embrace the sides and bottom of the receptacle A, bends being made at *e* to fit the corners of the box-body and allow the stiffening-rods to lie closely upon the outer surface of the same, said bends being made when the slides are erected in parallel planes to form a box. By proper means the rods *d* are clamped fast to the sides *a* and bottom *b* of the box-body A. Preferably the staples *g* are used for this purpose and are inserted through the wooden or other material of which the sides and bottom are composed and

clinched within. Said staples, being made to embrace the rods *d* when fully inserted and secured, serve to bind them upon the side and bottom walls of the box-body, so as to render the structure substantial.

The end walls *b* of the box A are each made of two thin pieces of material cut into proper shape to fit between the vertical sides *a*, and are of proper height to conform with the top edges of the sides when in place. The ends may also be made of one piece and fastened in a similar manner. Preferably each of the end walls *b* is made intercellular by the use of vertical spacing-strips *b'*, which are inserted between the two thin portions of each end wall, so as to separate them a slight distance and retain these pieces parallel to each other when they are properly secured together. Any suitable number of strips *b'* are employed, there being one at each side edge of the composite end walls, as shown in Fig. 1.

The end walls *b* of the box-body A are set in a short dis- [fol. 1174] tance from the ends of the side walls *a* to permit the battens *i* to be located on the end walls and have their outer edges secured to the end portions of the side walls by the staples *i'*, the thickness of the battens being so proportioned that they will form a strong re-enforcing brace for the ends of the box-body when they are thereto attached by the staples *i'* or other similar means. The mitered ends of the battens *i* are notched into steps *a'*, as shown in Fig. 1, which form of construction will prevent an outward wedging action at these points of contact if the box when closed is made to sustain weight on its lid.

The lid *c* of the box is provided with stiffening-rods *d'*, which are given equal spaces with the vertical rods *d* on the sides *a* and have integral loops or eyes formed on one end of each rod, which eyes are all located on one edge of the lid, there being similar eyes on the ends of the rods *d* at the upper edge of the box, so that the adjacent ends of these rods may be hooked together at one side edge of the lid, forming a series of hinge-joints for the lid that loosely connect the lid and box-body together. Each of the rods *d'* is secured to the lid by staples *d''*, that embrace the rod, and are affixed to the lid by clinching or other means, and the ends of said rods which are projected toward the free edge of the lid *c* are hooked over said edge, as represented

in Fig. 1. The lid *c* is also furnished with batten strips *c'*, which are attached to its ends and depend therefrom to interlock with the side battens *i* and rest on their upper ends when the lid is closed.

As a convenient means for securing the lid in place when closed, two turn-buckle latchhooks *k*, bent from wire, are loosely secured upon the depending batten-strips *c'* by insertion of a portion of the wire shanks of the latches through holes made transversely in the strips, and then bending the projecting portion at a right angle to the parts in the wooden battens, thus forming handles *k'* on the outside of the battens that will afford means for the rocking movement of the hooks *k*, which will engage them with the cross-pins *m* and hold the lid shut.

The peculiar construction of the box and manner of applying the stiffening-rods *d* hold the lid hinged to one side and both sides secured to the bottom of the box, and as the end walls may be removed by drawing the staples *i'* the box can be reduced to nearly flat surfaces by bending the rods *d* straight, which will permit the packing together in a compact bundle of a large number of the crates or boxes for shipment and transportation.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A box having composite top, bottom, and side walls, which are re-enforced by stiffening wire rods held in place by staples, and end walls which are intercellular and are secured in the side walls by end battens that are held to the sides and end walls by staples, substantially as set forth.

2. A box having its sides, lid, and bottom made of two pieces of material re-enforceed by wire rods and staples that hold the rods in place, end walls which are intercellular and secured to the sides and bottom by end battens which are notched into step form at their miters, and turn-buckle latches which are located on depending battens of the lid and adapted to interlock with cross-pins in the end walls of the box, substantially as set forth.

John Howenstine.

Witnesses: Edgar D. Rogers, John Dreibellins.

(Here follow side folios 1175 and 1176)

(No Model.)

A. H. RAMSEY.

CRATE.

No. 486,297. Patented Nov. 15, 1892.

Fig 1.

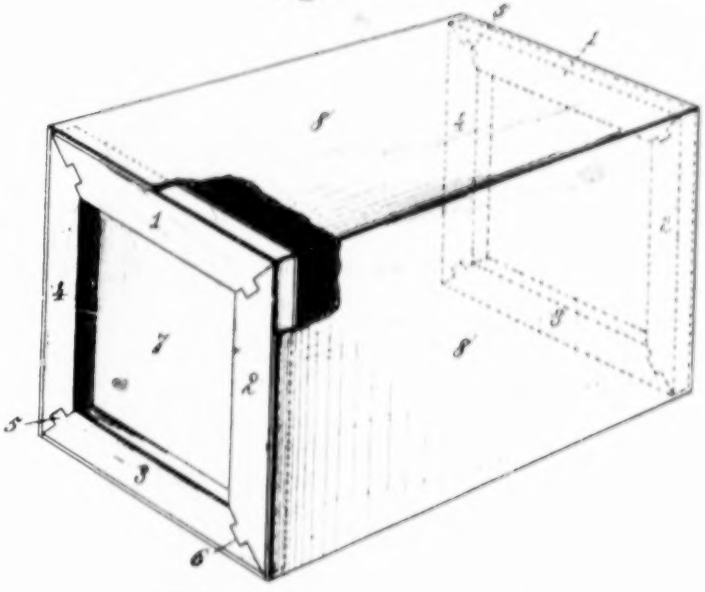


Fig 2.

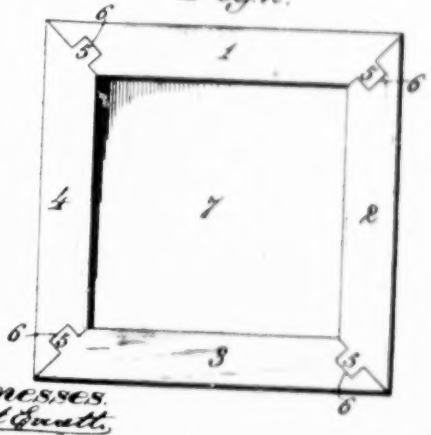


Fig 3.

Witnesses.
Robt Gantt.
J. A. Rutherford

Inventor.
Archie H. Ramsey.
By James L. Norris.
Atty

[fol. 1177] United States Patent Office

Archie H. Ramsey, of Rutland, Florida

Crate

Specification Forming Part of Letters Patent No. 486,297, Dated November 15, 1892

Application filed March 10, 1892. Serial No. 424,416. (No Model.)

To all whom it may concern:

Be it known that I, Archie H. Ramsey, a citizen of the United States, residing at Rutland, in the county of Sumter and State of Florida, have invented new and useful Improvements in Shipping Boxes or Crates, of which the following is a specification.

This invention has for its object to provide a new and improved head for orange and other boxes or crates, which is efficient, durable, and economical, and wherein the strips composing the rectangular open frame of the box-head are securely connected without nails or other extraneous fastening devices in such manner that they are not liable to become separated by the rough usage incident to transportation, while they can be quickly and conveniently connected by merely interlocking their end portions without resorting to dovetails.

To accomplish this object, my invention involves the features of construction and the combination or arrangement of parts hereinafter described and claimed, reference being made to the accompanying drawings, in which—

Figure 1 is a broken perspective view of a shipping box or crate embodying my invention. Fig. 2 is a detail plan view of the open frame of the box-head, and Fig. 3 is a transverse sectional view of the same.

In order to enable those skilled in the art to make and use my invention, I will now describe the same in detail, referring to the drawings, wherein—

The numerals 1, 2, 3, and 4 indicate the rectangular strips which compose the open frame of the box-head. These strips are formed with parallel inner and outer edges, and each strip is provided at one end with a tongue 5 and at the

opposite end with a groove or mortise 6, which tongue and groove or mortise extend at obtuse angles to the inner longitudinal edge of the strip, so that when the parts are assembled and engaged with each other, as in Fig. 2, they are securely held against displacement without resorting to the use of nails or other extraneous fastening devices for this purpose.

By forming the strips with tongues and grooves, as shown, three of the strips can be engaged with each other by inserting the tongue of one lengthwise into the groove of another, but the fourth or final strip must be applied by introducing it sidewise in a plane parallel with the sides of the three connected strips, so that such fourth or final strip completes the tying of all the strips together, by which means I accomplish the result of dispensing with extraneous fastenings. When the strips are engaged with each other in the manner explained, the oblique arrangement of the tongues and grooves relatively to the edges of the strips renders it impossible to pull them apart by pressure or strain applied in an outward direction in the plane of the several strips, and this result is accomplished by simply providing a single tongue at one end of each strip, so that I avoid constructing one end of each strip with two tongues or tenons located at right angles to each other for the purpose of interlocking with two grooves or mortises in another strip.

In my invention the strips are the counterpart of one another, so that waste of time is avoided in assembling them together, since a workman can take up the strips indiscriminately and then connect them with each other, and, furthermore, one set of machinery is sufficient to manufacture the strips, owing to their being identical in construction.

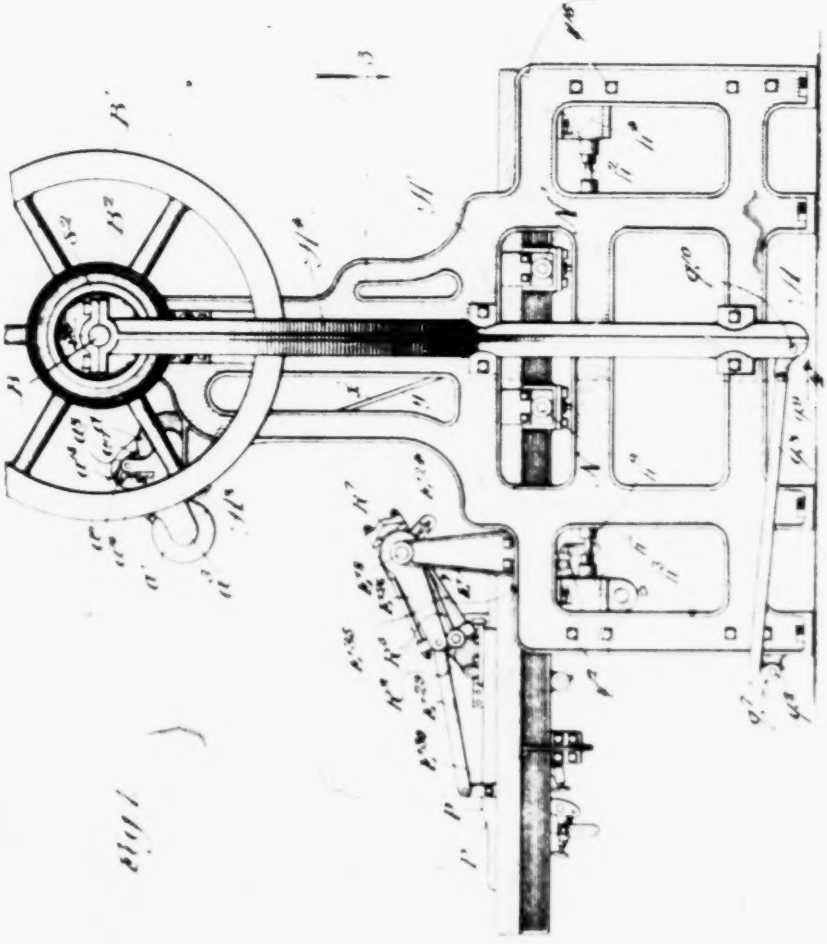
When the open rectangular frame is formed, a sheet 7, of wood or veneering, is applied to one side of the frame to complete the box-head, as will be understood by reference to Figs. 1 and 3. In practice one of these heads is used at each end of the box or crate, and the side walls of 8 of the latter are composed of sheets of wood or veneering nailed or otherwise secured to the edges of the box-heads as will be understood by those familiar with this character of boxes or crates for shipping oranges and other fruits or vegetables.

(No Model.) 17 Sheets—Sheet 1.

T. L. KNUDTSON & J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

No. 518,038. Patented Apr. 10, 1894.



Witnesses.

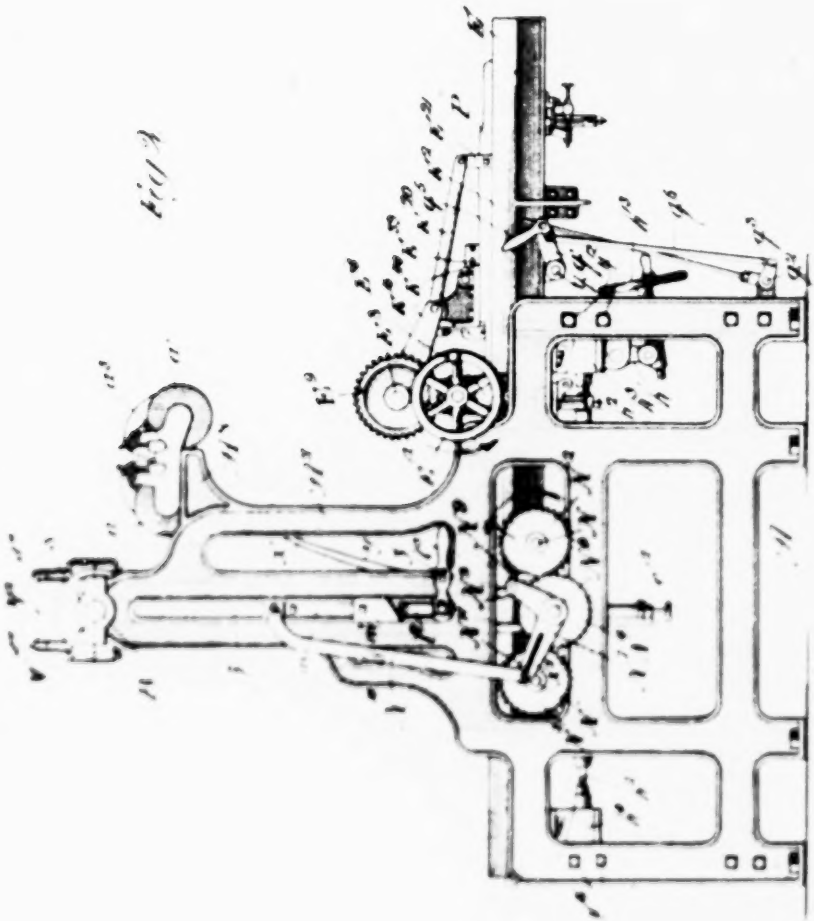
Inventors.

(No Model.) 17 Sheets—Sheet 2.

T. L. KNUDTSON & J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

No. 518,038 Patented Apr. 10, 1894.



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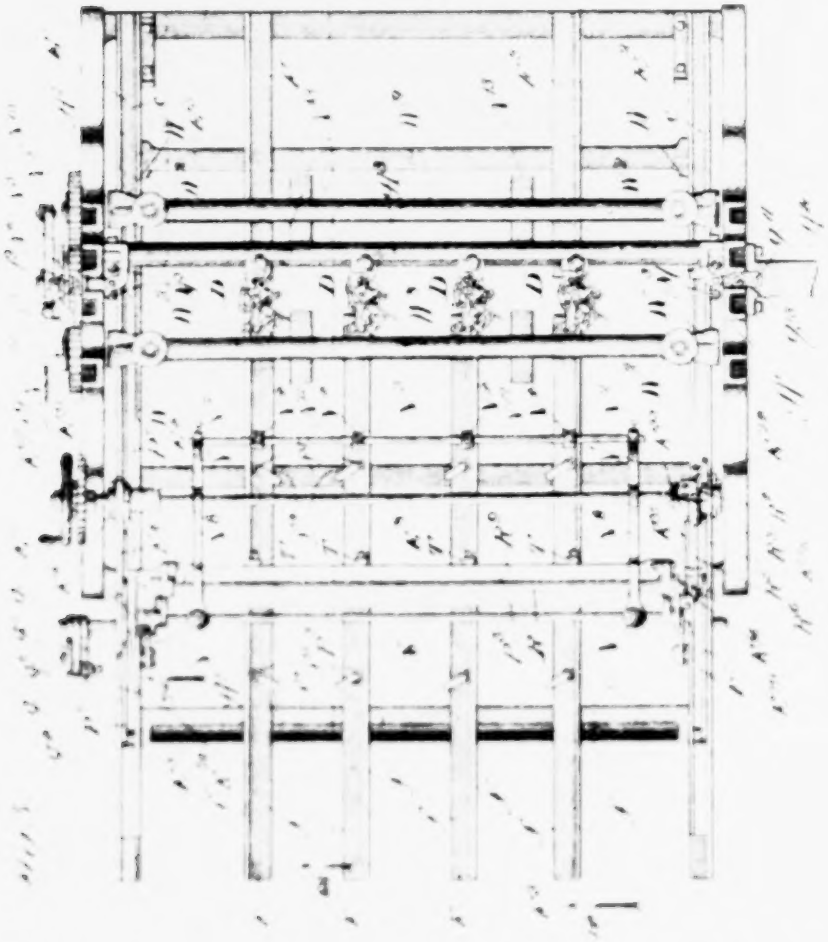
T. L. KNUDTSON & J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

No. 518,038. Patented Apr. 10, 1894.



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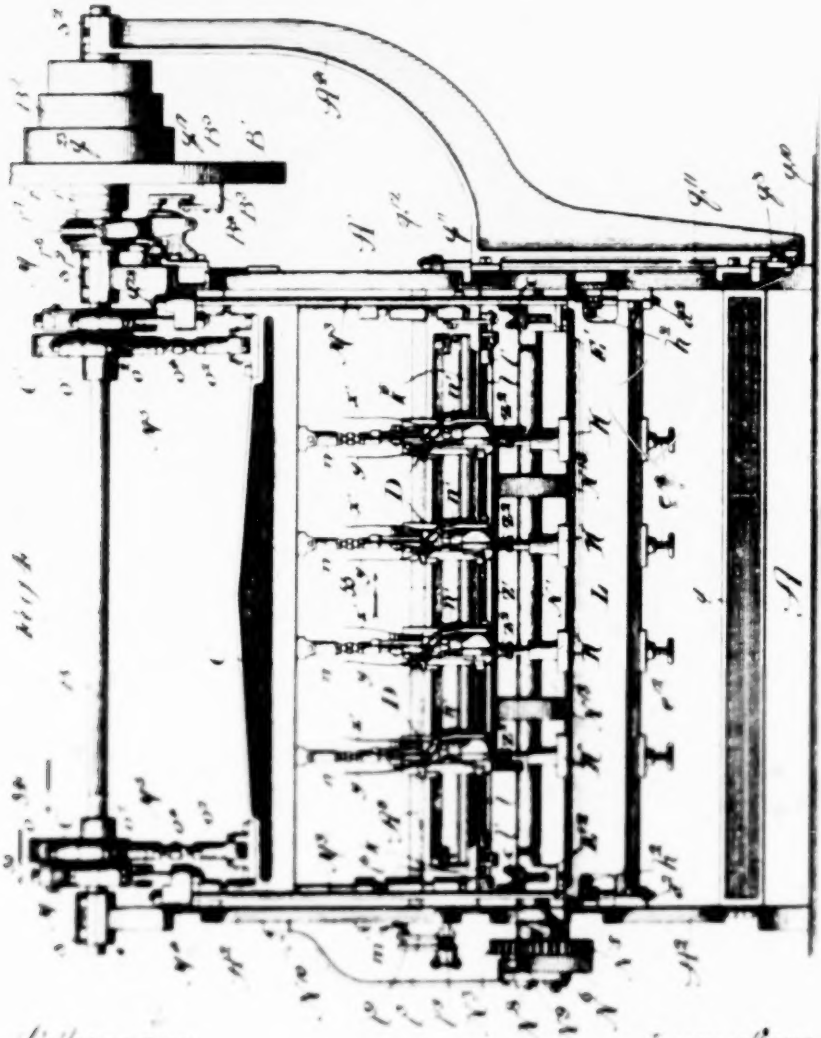
T. L. KNUDTSON & J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

No. 518,038. Patented Apr. 10, 1894.



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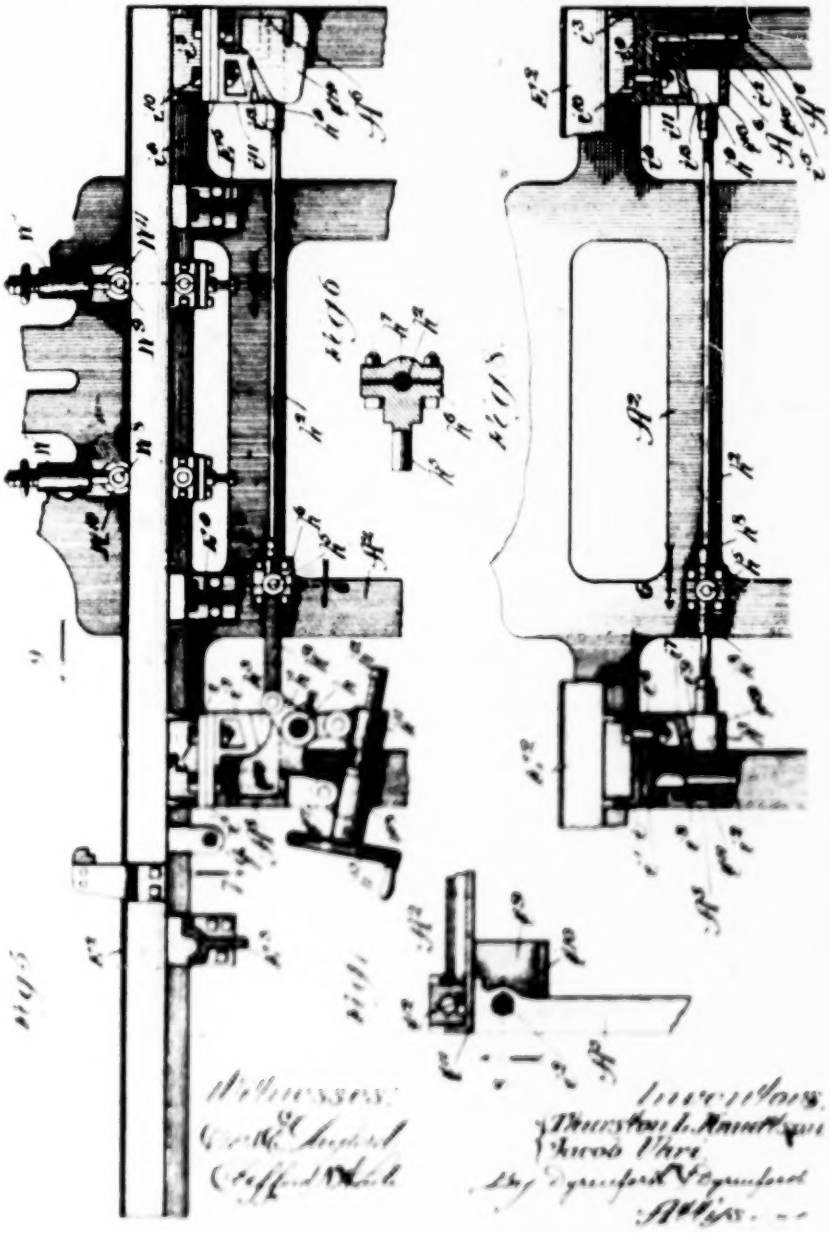
T. L. KNUDTSON & J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

No. 518,038. Patented Apr. 10, 1894.



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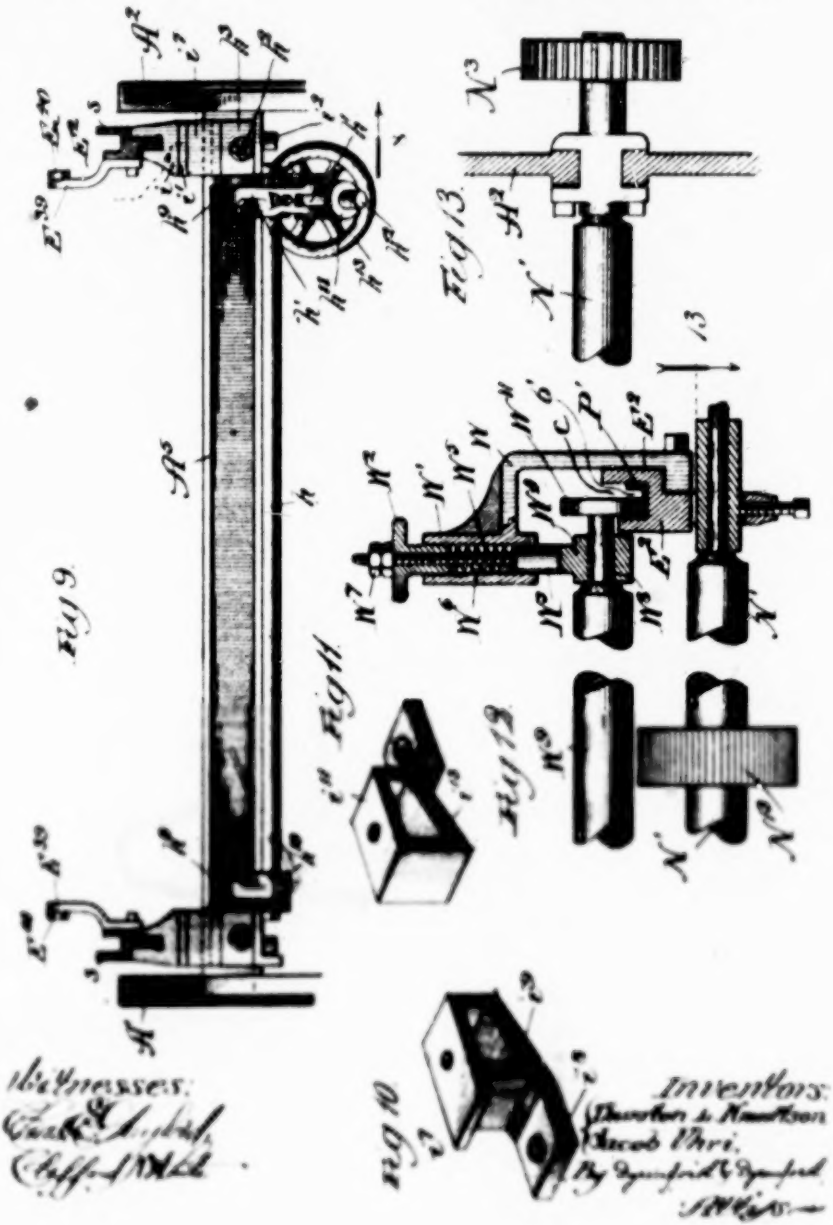
T. L. KNUDTSON & J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

No. 518,038. Patented Apr. 10, 1894.



Witnesses:

Inventors:

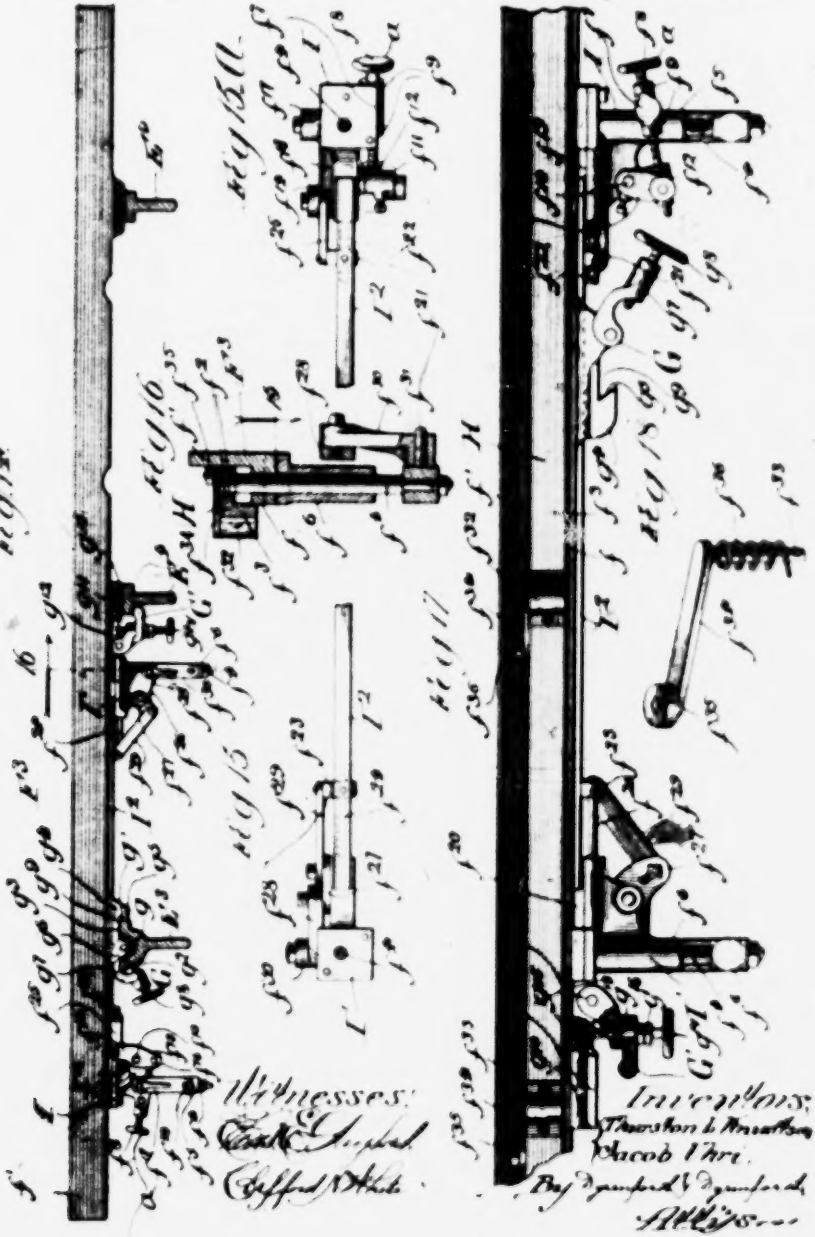
1191-1192

(No Model.) 17 Sheets—Sheet 7

T. L. KNUDTSON & J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

No. 518,038. Patented Apr. 10, 1894.



Witnesses:

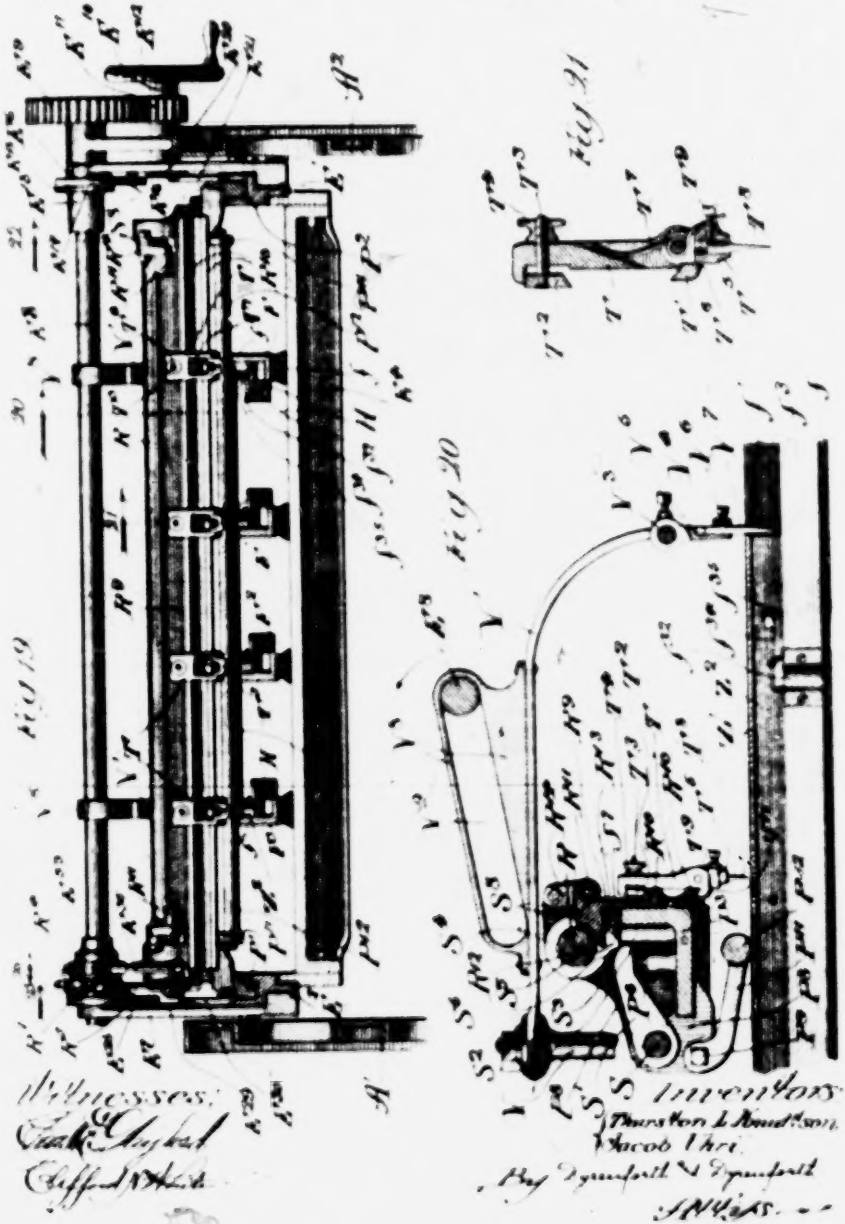
Inventors:

No Model.) 17 Sheets—Sheet 8

T. L. KNUDTSON & J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

No. 518,038. Patented Apr. 10, 1894.



Witnesses:
Frank Seybal
Clifford Wheeler

Inventors
Thurston L. Knudtson
Jacob Uhri
By Dyrenforth & Dyrenforth
Attys.

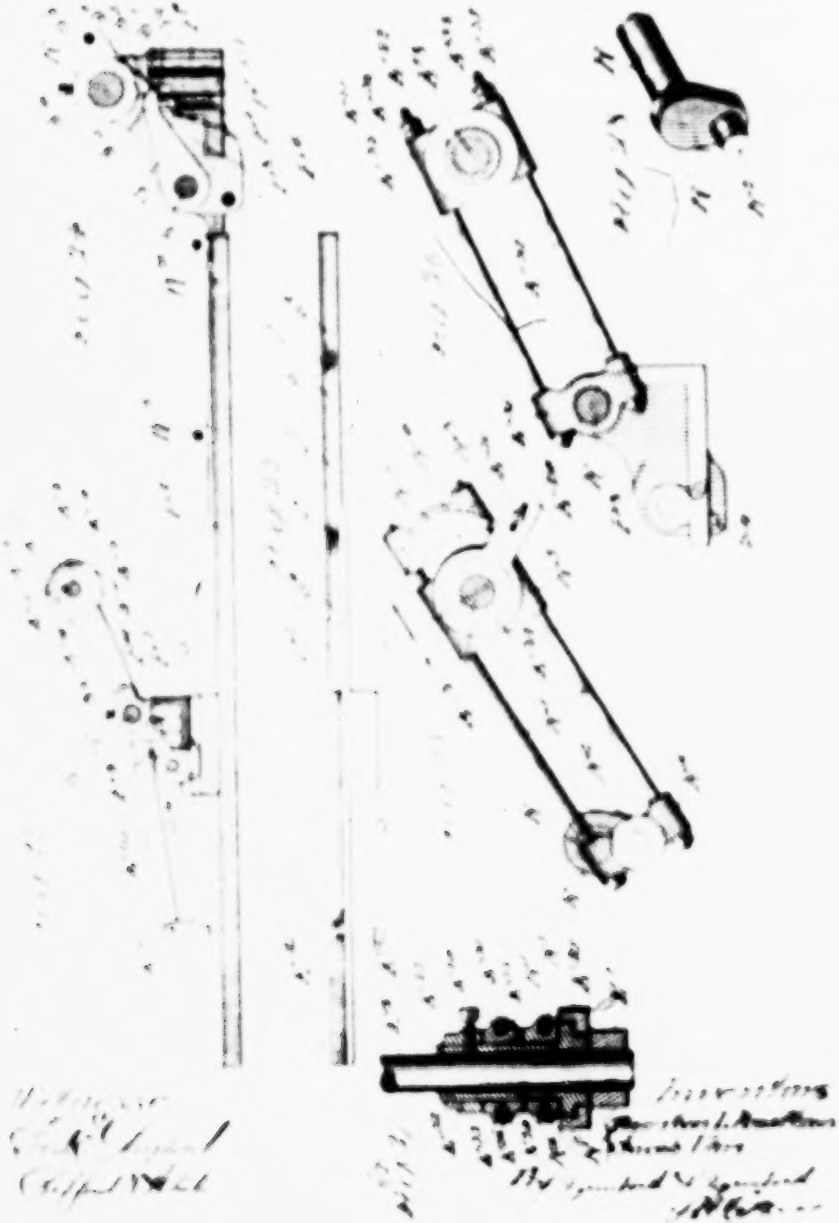
1195-1196

(7 Sheets—Sheet 1)

T. L. KNUDTSON & J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

No. 518,038. Patented Apr. 10, 1894.



(No Model.) 17 Sheets—Sheet 10

T. L. KNUDTSON & J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

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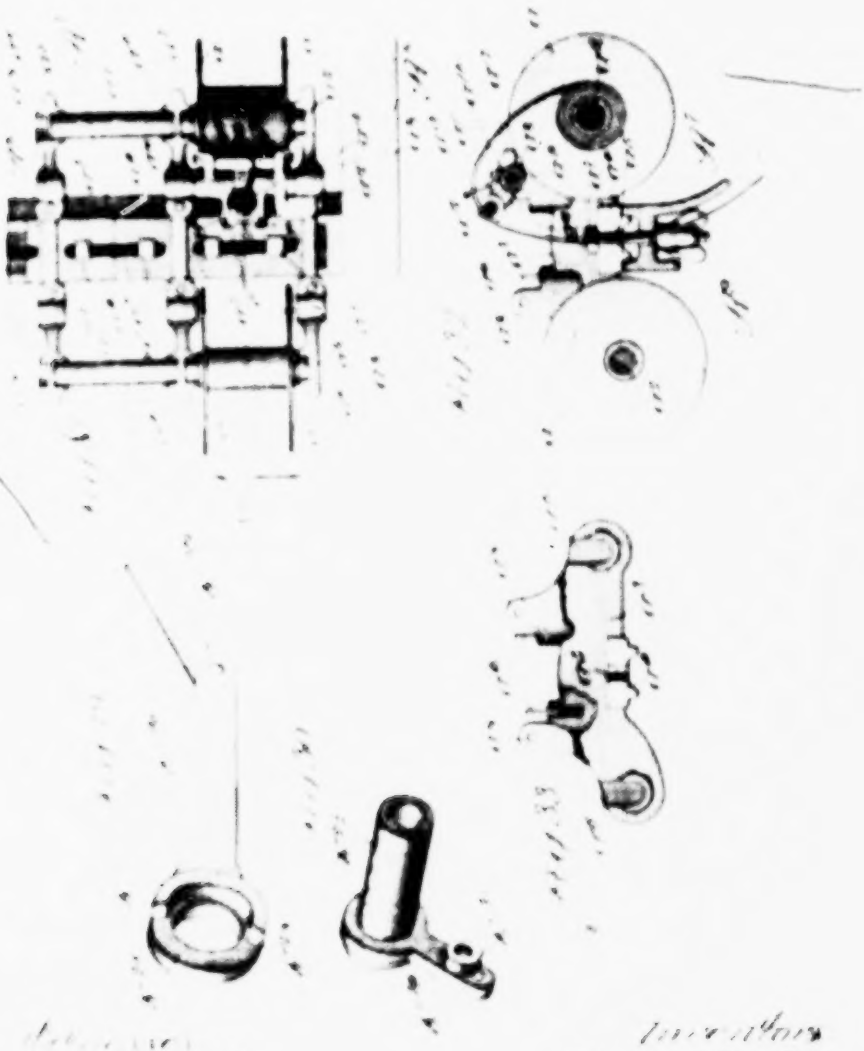


Witnesses:

Inventors:
Thorston L. Knudtson
Jacob Uhri

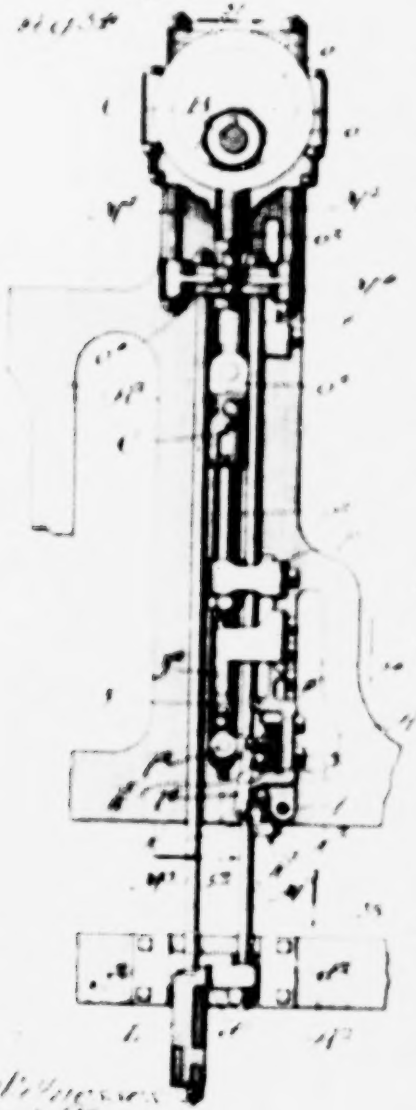
1199-1200

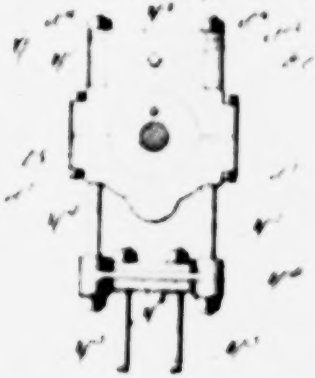
(No Model.) (2 Sheets—Sheet 1.)

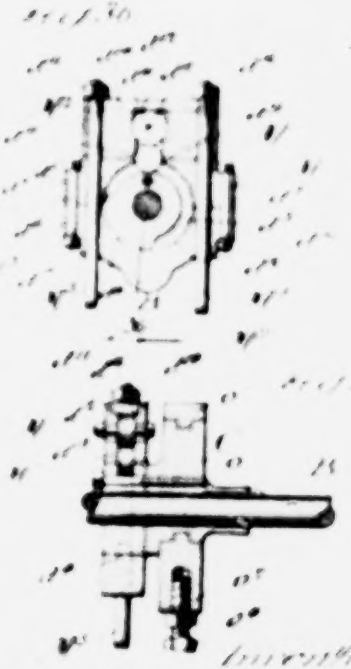
T. L. KNUDTSON & J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

No. 518,038. Patented Apr. 10, 1894.







Witnesses
Chas. L. Wyeth
Jeff. Adams

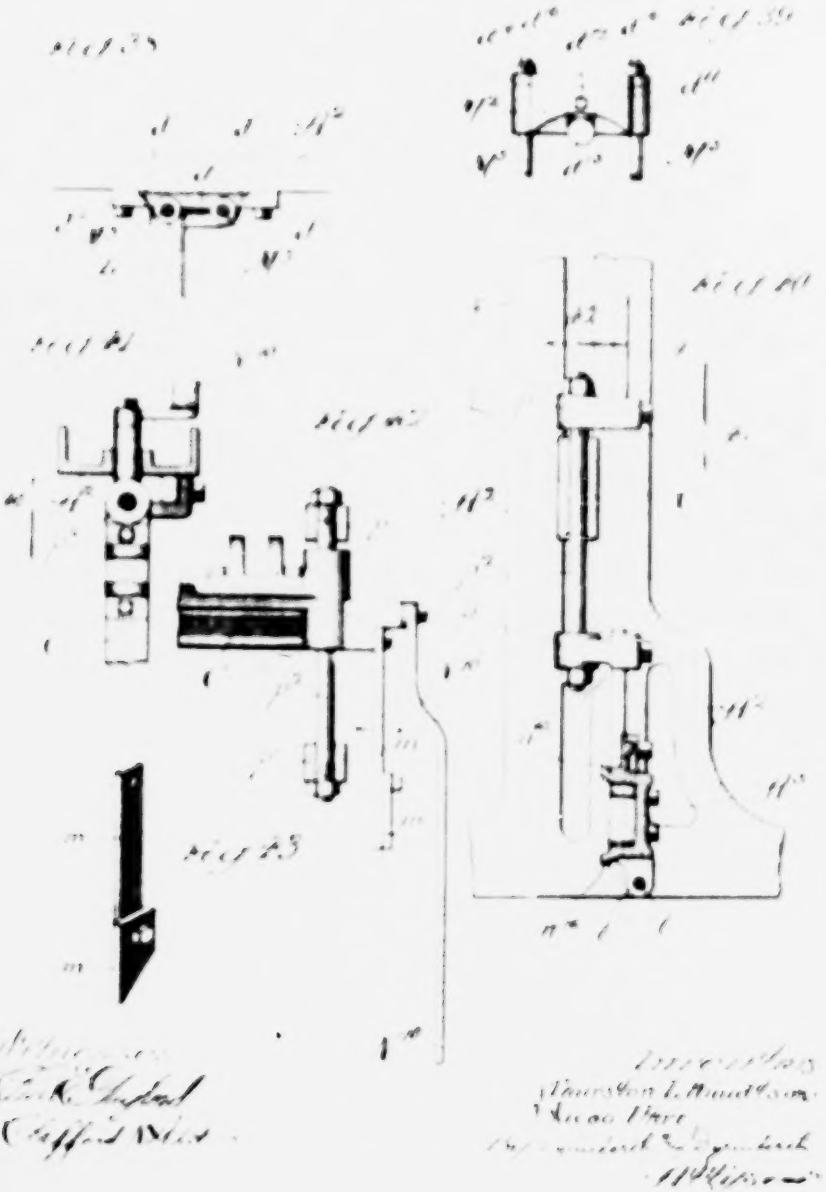
Inventors
Thos. L. Knudtson
John Uhri
by their Attorneys
Wyeth & Wyeth

(No Model.) (7 Sheets—Sheet 1.)

T. L. KNUDTSON & J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

No. 518,038. Patented Apr. 10, 1894.



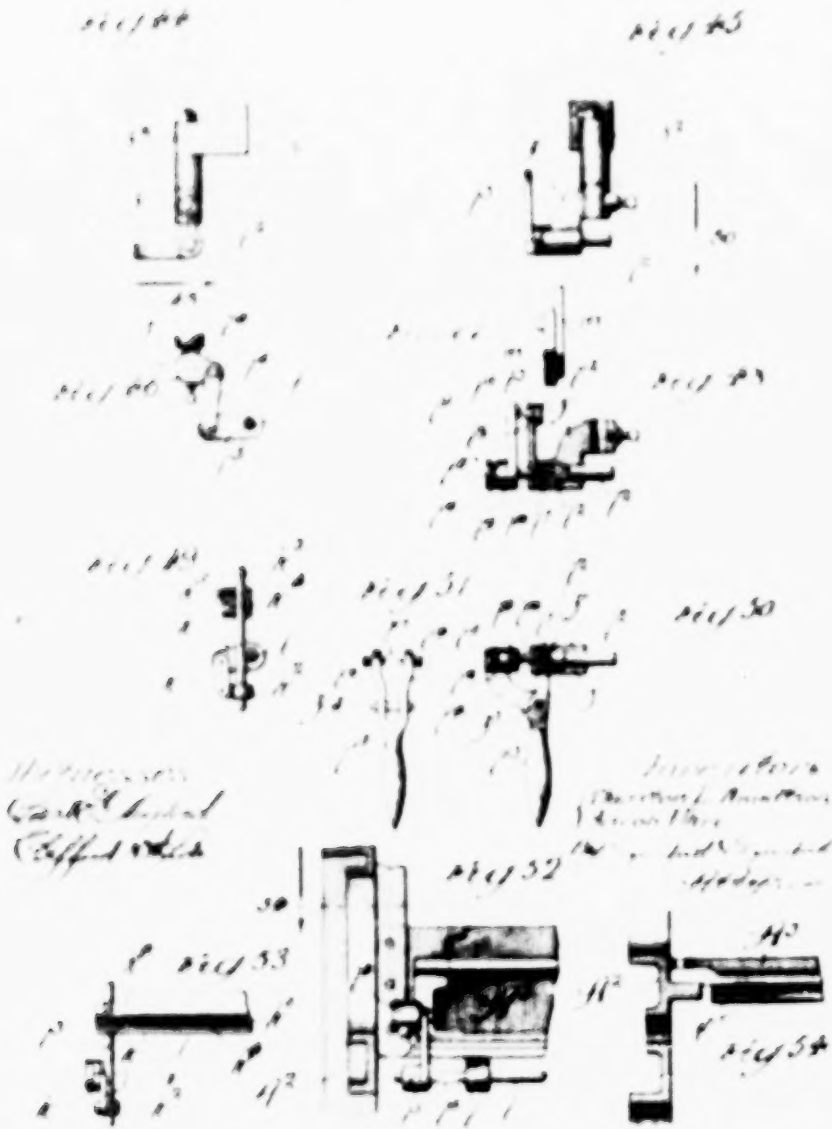
1203-1204

17 Sheets—Sheet 11.

T. L. KNUDTSON & J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

No. 518,038. Patented Apr. 10, 1894.



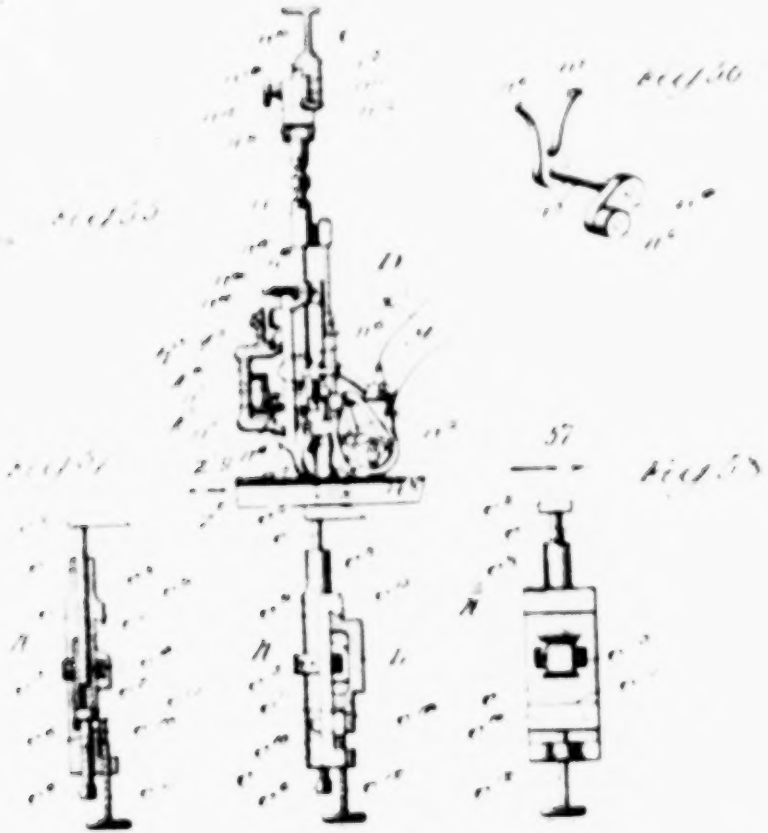
1205-1206

(No Model.) 17 Sheets—Sheet 14

T. L. KNUDTSON & J. UHRI

MACHINE FOR MAKING BOX BLANK.

No. 518,038 Patented Apr. 10, 1894



Witnesses
Chas. C. Linnell
Geo. H. Graves

Inventors
Thomas L. Knudtson
John Uhri
by Dewey & Co. their attorneys

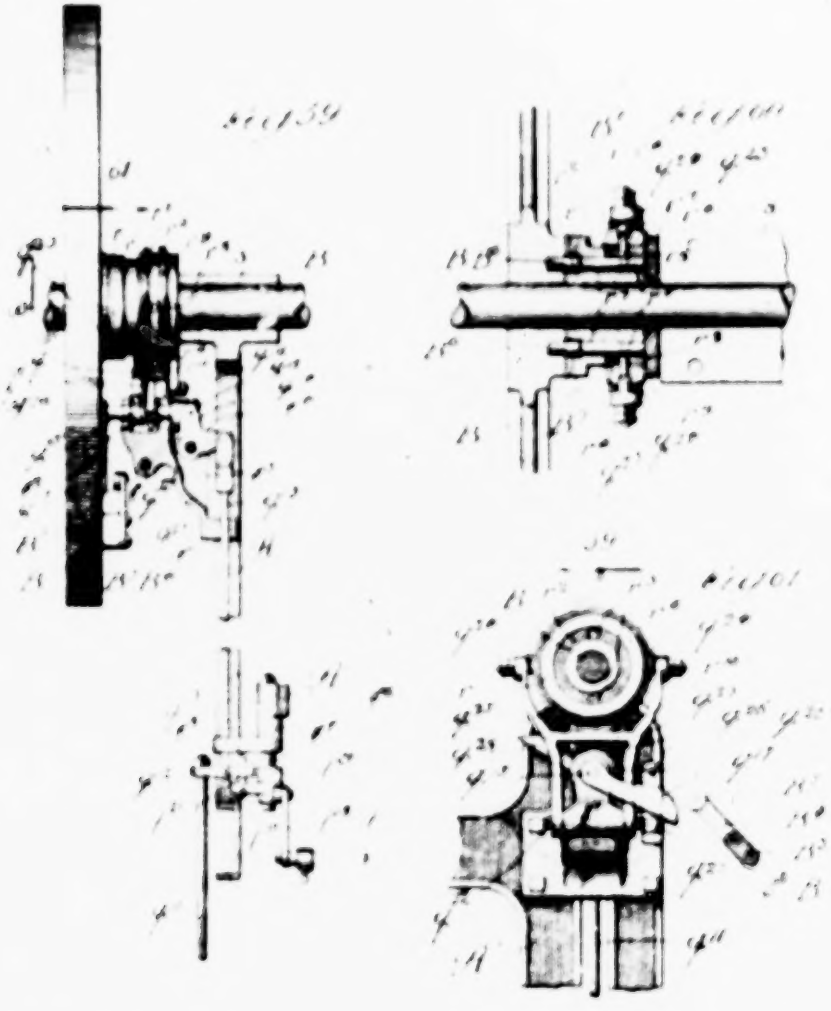
1207-1208

(No Model.) (7 Sheets—Sheet 1.)

T. L. KNUDTSON & J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

No. 518,038. Patented Apr. 10, 1894.



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T. L. KNUDTSON & J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

No. 518,038. Patented Apr. 10, 1894.

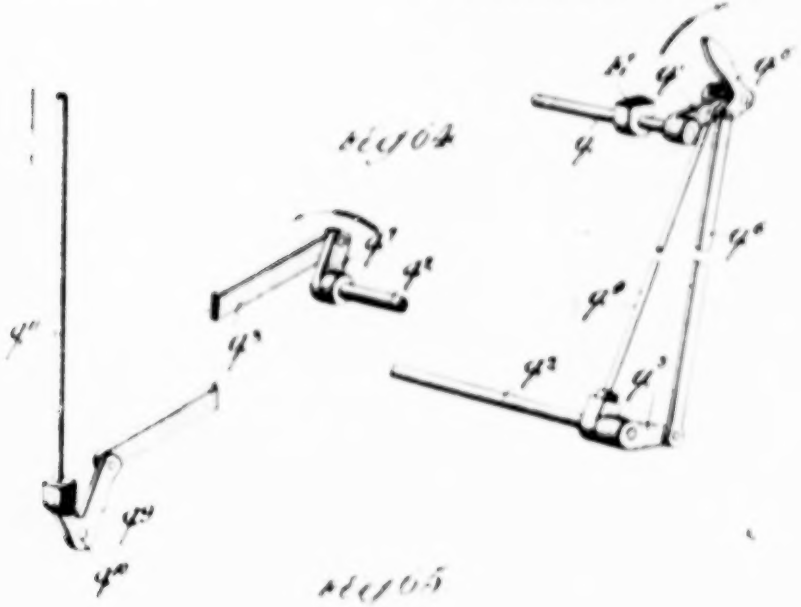


Fig 64

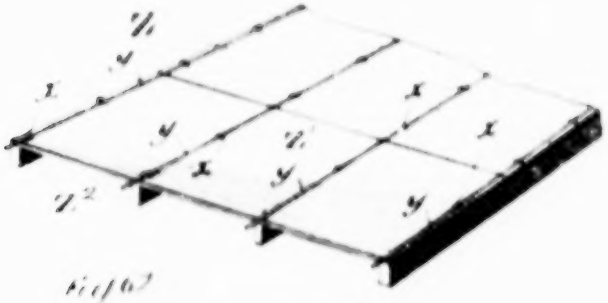


Fig 65

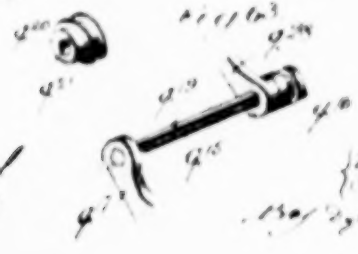


Fig 66

Fig 66a

Witnesses:

Inventors:

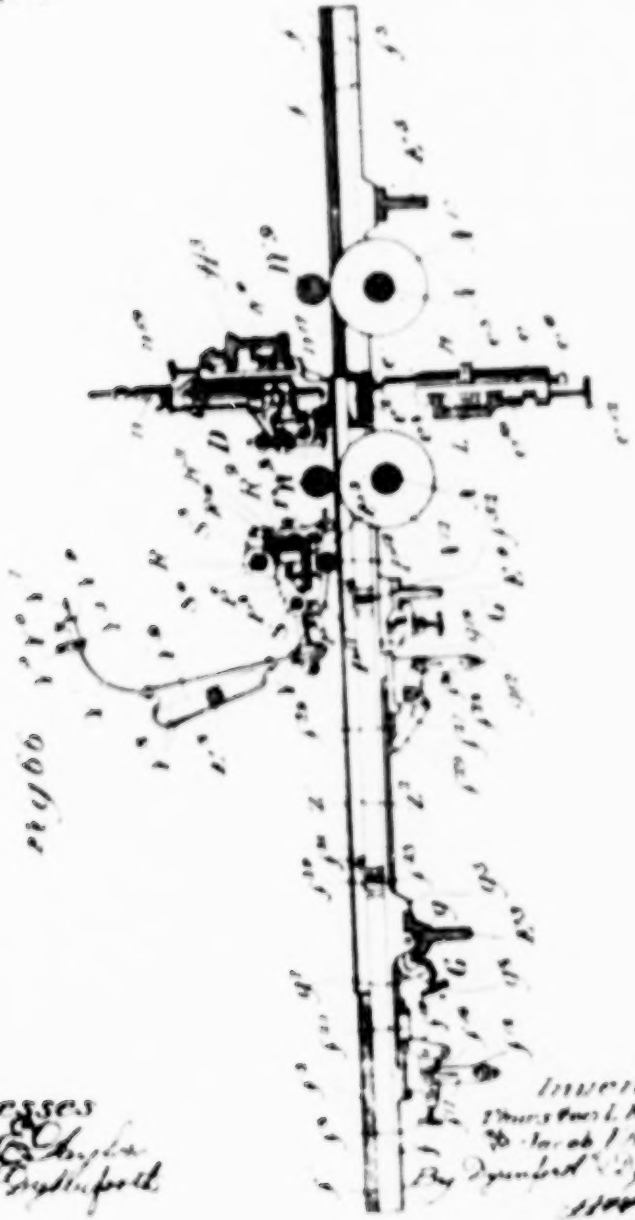
1211-1212

(No Model.) (7 Sheets—Sheet 1)

T. L. KNUDTSON & J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

No. 518,038 Patented Apr. 10, 1894.



Witnesses

Having thus described my invention, what I claim is—

1. A head for a shipping box or crate, consisting of counterpart strips, each formed with a tongue at one end and a groove at the opposite end, which extend at obtuse angles to the inner longitudinal edge of the strip, the tongues and grooves being engaged with each other, and a sheet of wood or veneer secured to one side of the connected [illegible] strips, substantially as described.

2. A shipping box or crate comprising the side walls s and a box-head composed of counterpart strips, each formed with a tongue at one and a groove at the opposite end, which extend at obtuse angles to the inner longitudinal edge of the strip, the tongues and grooves being engaged with each other and the side walls of the box being secured to the edges of the heads, substantially as described.

In testimony whereof I have hereunto set my hand and affixed my seal in presence of two subscribing witnesses.

Archie H. Ramsey (L. S.)

Witnesses: Wm. O. Johnson, F. L. Rutland.

(Here follow side folios 1179 1212)

[illegible] United States Patent Office.

Thurston L. Knudtson and Jacob Uhrt, of Chicago, Illinois.

Machine for Making Box-blanks.

Specification forming Part of Letters Patent No. 518,308, Dated April 10, 1894.

Application Filed February 10, 1893.

Serial No. 461,785. (No model.)

To all whom it may concern:

Be it known that we, Thurston L. Knudtson and Jacob Uhrt, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a

new and useful Improvement in Machines for Making Box Blanks, of which the following is a specification.

Our object, broadly stated, is to provide a machine of improved construction, for driving staples into material fed by the machine intermittingly across the staple drivers.

Our object is more especially to provide a machine for making a certain box blank. The box blank consists of thin sheets of lumber provided on one side with cleats, and on its opposite side, coincident with the cleats, with strips of wire held in place by staples which pass through the sheets of lumber and into the cleats to hold the wires, sheets and cleats together. In Figure 65 of the drawings, a broken perspective view is given of the blank to be manufactured. The thin sheet of lumber is formed of veneering or backing in strips of the same or different widths extending side by side. The cleats, usually, though not necessarily four in number, extend transversely of the strips which afford the sheet, and the strengthening wires extend transversely of the said strips and coincidently with the cleats as shown. The ends of the wires extend beyond the opposite ends of the blank as shown.

Our present invention has only to do with the manufacture of blanks of the general form shown in the figure referred to, but it may be stated that to form the blanks into boxes the cleats are cut, as indicated by dotted lines, to make four separate lengths and the blank is bent over at the points where the cleats are cut to afford the four sides of the box, the opposite ends of the blank being secured by twisting together the projecting ends of the wires. The cleats at the opposite ends of the blank, when the latter is bent into the form of a box as described, are at the opposite ends respectively of the box, and box ends may be nailed or otherwise secured upon the said end cleats to complete the box.

In the machine forming the subject of the present application, the cleats are placed in guides extending longitudinally of the machine, strips of backing, veneering or the like are placed upon and transversely of the cleats and the machine is then set in motion to carry the cleats, and a sheet formed by the strips of backing or veneering, beneath devices which feed strengthening wires to the sheet and staple the same to the sheet and cleats, as before stated, to produce the blank.

In the drawings Fig. 1 is an elevation partly broken of one side of the machine; Fig. 2, a view in elevation of the opposite side of the machine; Fig. 3, a sectional plan view with a part broken away, the section being taken on line 3 of Fig. 1; Fig. 4, a vertical cross section taken on line 4 of Fig. 1; Fig. 5, an enlarged section taken on line 5 of Fig. 3 in the direction of the arrow and illustrating mechanism for raising and lowering the bed of the machine; Fig. 6, a cross section of a detail of the raising and lowering mechanism taken on line 6 of Figs. 5 and 8; Fig. 7, a broken sectional plan view of one corner portion of the bed frame, the section being taken on line 7 of Fig. 5; Fig. 8, a broken sectional elevation taken on line 8 of Fig. 7; Fig. 9, a section taken on line 9 of Fig. 5 across the machine, in the direction of the arrow, and showing the connecting shaft between the raising and lowering mechanisms at opposite sides of the bed frame; Figs. 10 and 11 perspective detail views of cam faced bearings forming part of the said raising and lowering mechanism; Fig. 12, an enlarged broken, and partly sectional, view of details forming part of the feed mechanism for the material to be worked upon, the section being taken on line 12 of Fig 5; Fig. 13, a broken sectional plan view taken on line 13 of Fig. 12 in the direction of the arrow; Fig. 14, a section taken on line 14 of Fig. 3; viewed in the direction of the arrow, and showing one of the end cleat guides with its attachments in elevation; Figs 15 and 15ª broken sectional plan views of end portions of the guide bar shown in Fig. 14, the section being taken on line 15 of Fig 16; Fig. 16, an enlarged section taken on line 16 of Fig. 14, and viewed in the direction of the arrow; Fig. 17, an enlarged view broken away at the ends showing the opposite side of the guide bar illustrated in Fig. 14; Fig. 18, a perspective detail view of one of the spring clamps for a [fol. 1214] cleat, mounted on the guide bar described; Fig. 19, a broken cross section of the machine, the section being taken on line 19 of Fig. 3, and viewed in the direction of the arrow; Fig. 20, a broken section taken on line 20 of Fig. 19, viewed in the direction of the arrow, and enlarged; Fig. 21, an enlarged section of a detail, the section being taken on line 21 of Fig. 19 and viewed in the direction of the arrow; Fig. 22, a section taken on line 22 of Fig. 19, and illustrating a slide bar detail; Fig. 23, a top plan view of the slide bar shown in

Fig. 22, Fig. 24, an enlarged section taken on line 24 of Fig. 3, showing details of construction; Figs. 25 and 26 enlarged sections taken, respectively, on lines 25 and 26 of Fig. 19 showing certain details in elevation; Fig. 27, a section taken on line 27 of Fig. 25, and viewed in the direction of the arrow; Fig. 28, a perspective view of a crank; Figs. 29 and 30 perspective views of details of the feed mechanism for the material to be worked upon; Fig. 31, an enlarged broken plan view of supporting racks for spools carrying wire; Fig. 32, a section taken on line 32 of Fig. 31, and viewed in the direction of the arrow; Fig. 33, a partly broken side elevation of one of the spool supports; Figs. 34 and 35 enlarged broken sectional views taken respectively on lines 34 and 35 of Fig. 4; Fig. 36, a section on line 36 of Fig. 37 viewed in the direction of the arrow; Fig. 37, a broken section taken on line 37 of Fig. 34; Fig. 38, a broken plan sectional view taken on line 38 of Fig. 34; Fig. 39, a broken side elevation of certain features of the construction of the parts shown in Figs. 35, 36 and 37, detached; Fig. 40, a broken sectional elevation showing in detail certain features illustrated in Fig. 34, the section being taken on line 40 of Fig. 41; Figs. 41 and 42 broken sectional plan views taken on lines 41 and 42, respectively, of Fig. 40; Fig. 43, a perspective view of a switch cam shown in Fig. 2; Fig. 44, a view in side elevation of a bracket detail; Fig. 45, a front elevation of the same; Fig. 46, a detail view of cranks and a link connection therefor; Fig. 47, a broken view in side elevation of the switch cam illustrated in Fig. 43, showing it in proper relation to switch mechanism illustrated partly in section and partly in elevation in Fig. 48, the section being on line 48 of Fig. 44, viewed in the direction of the arrow; Fig. 49, a sectional view of parts of the switch mechanism connected with and actuated by the mechanism shown in Fig. 48; Fig. 50, a sectional plan view taken on line 50 of Fig. 45, and showing an operating handle; Fig. 51, a detail view in front elevation of the handle illustrated in Fig. 50; Fig. 52, a broken section taken on line 52 or Fig. 34; Fig. 53, a broken view in front elevation of the mechanism shown by sectional view in Fig. 49; Fig. 54, a broken sectional plan view taken on line 54 of Fig. 52 corresponding with line 54 of Fig. 31; Fig. 55, a staple making and driving and strengthening

wire feeding machine, at 4 a clincher showing the manner of supporting them in position, the view being a section taken on line 55 of Fig. 4, enlarged, and viewed in the direction of the arrow; Fig. 56, an enlarged perspective view of a detail forming part of the mechanism illustrated in Fig. 55; Fig. 57, a vertical central section of the clincher, the section being taken on line 57 of Fig. 58; Fig. 58, a front elevation of the clincher shown in Fig. 55; Fig. 59, an enlarged sectional elevation of clutch mechanism for starting and stopping the machine, the section being taken on line 59 of Fig. 61, corresponding with line 59 of Fig. 1; Figs. 60 and 61 sections taken, respectively, on lines 60 and 61 of Fig. 59 and viewed as indicated by the arrows; Fig. 62, an enlarged perspective view of a worm sleeve forming part of the operating mechanism for the clutch shown in Figs. 59, 60 and 61; Fig. 63, a broken perspective detail view of other features of the said clutch operating mechanism; Fig. 64, broken perspective views of details of mechanism for operating the clutch to start and stop the machine; Fig. 65, a broken perspective view of one of the box blanks which the machine is designed to manufacture; and Fig. 66, a longitudinal section taken on line 66 of Fig. 3 and viewed in the direction of the arrow.

A is the main frame of the machine formed with the side castings A' A² secured together in rigid relation by a cross bar f at the rear of the machine, a similar cross bar at the forward end portion thereof, other across extending bars, which will be hereinafter referred to, and a cross beam A³. On the side A' is a bracket A⁴, shown most clearly in Fig. 4.

B is the drive shaft of the machine journaled in bearings s s' and s², at the tops, respectively, of the sides A' A² and bracket A⁴. Loose upon the drive shaft B is a driver in the form of an integral fly-wheel B' and step pulley B². On the inner side of the fly-wheel is a lug B³ carrying an arm B⁴ which extends toward the shaft B in a plane parallel with the fly-wheel. At the outer side of the free end of the arm B⁴ is a wheel B⁵. The mechanism for producing and releasing engagement between the drive pulleys B² and the drive shaft B is shown in detail in Figs. 59 to 64 inclusive. The inner face of the hub portion of the fly-wheel is provided with two diametrically opposed threaded openings B⁶ in which are screwed two short pins B⁷. At the side of the hub

of the fly wheel is a sleeve r fixed to the shaft and having a circumferential annular recess r', and provided in its face adjacent to the fly wheel with an annular groove r^2 into which the pins B project. Extending through the sleeve r parallel with and at opposite sides of the shaft B are diametrically opposed openings r^3 which intersect the groove r^2. Extending from the openings r^3 to the recess r' are elongated openings or slots r^4. In the openings r^3 and adapted to slide therein are pins r^5. Around the recess r' [fol. 1215] is a loose collar r^6 having a circumferential groove r^7. Extending through radial openings in the collar r^6 and through the slots r^4 are pins r^8 which engage openings in the pins r^5 to form virtually integral parts of the latter. Movement of the collar r^6 in the direction of the hub of the fly wheel causes it to move the pins r^8 in the slots r^4, and through the said pins to move the pins r^5 longitudinally in the direction of the hub of the fly wheel, and into the path of the pins B, whereby the shaft will be revolved with the fly wheel and drive pulleys.

Movement of the clutch described to bring about the engagement of the shaft B and the drive pulleys is effected by means of the following shipping mechanism: (See Figs. 1, 2, 59 and 64.) Journaled in a raising and lowering bed frame to be hereinafter described and extending transversely across the machine near the forward end of the latter is a rod q which projects beyond the side A^2. On the end portion of the said shaft is a link q'. Directly below and extending parallel with the rod q is a shaft q^2 provided adjacent to the side A^2 with a crank q^3. Pivoted upon the end of the shaft q^2 and at its opposite end to the free end of the link q' is a stay rod q^4. On the end of the link q' is a handle q^5 in the form of a bell crank pivoted between its ends to the link q'. A link q^6 is pivotally connected at its opposite ends to the short arm of the handle q^5 and the free end of the crank q^3. At the side A' of the machine the shaft q^2 carries a crank q^7 pivotally connected at its free end with a reciprocal backward extending bar q^8. A bell crank lever q^9 is pivoted at q^{10} to the lower end of the bracket A^4 at the inner face of the latter, and at the end of one of its arms is pivotally connected with the bar q^8. Between the bracket A^4 and side A' of the machine is a vertical recess (see Fig. 4) formed by a concavity of the

bracket, in which is a vertically reciprocal rod q^{14} pivotally connected at its lower end with the bell crank q', as shown most clearly in Fig. 64. At the top of the rod q^{14} (as most clearly shown in Fig. 59), and fixed to the said rod is a horizontal plate q^{15} from the center of which rises a vertical rod q^{16}, movable in a guide opening in the end of a bracket t^6 on the side A' of the machine. On the side A' and extending in an upward direction between the same and the fly-wheel B' as a bracket t' provided in its upper end with a recess t^2 and at its side adjacent to the frame A' with a recess t. Journaled in the bracket and extending across the recess t^2 is a short shaft t^3; and on the said shaft in the recess t^2 is a bell crank lever q^{17} pivotally connected at the free end of one of its arms with the upper end of the rod q^{16}. Parallel with the shaft B and extending across the recess t^2 through openings in the bracket t' is a longitudinally movable shaft q^{18}, carrying at its rear end a grooved collar q^{19} and at its forward end an arm q^{20}. At the upper end of the bell crank lever q^{17} is a pin q^{21} which extends loosely into the groove of the collar q^{19}. The shaft q^{18} is provided with a longitudinal groove or keyway q^{22} (see Fig. 63), and on the said shaft in the recess t^2 of the bracket is a worm sleeve q^{23} provided with a feather q^{24}, which extends into the key-way q^{22}. The worm q^{23} will thus be caused to turn with the shaft q^{18} while permitting the latter to be moved longitudinally through it, as hereinafter described. Pivoted at its lower end to a bearing shaft q^{25} on the bracket t' is a stirrup frame q^{26} which at its free end embraces the collar r^6 and is provided with inward projecting pins q^{27} which extend into the annular groove r^7 of the said collar. The stirrup frame is provided with a cross bar q^{28} carrying a downward extending lug q^{29}, which engages the worm of the worm sleeve q^{23}, as shown most clearly in Fig. 59. On the shaft B between the sleeve r and the bearing s is a collar r^9 carrying a radially extending arm r^{10}; and on the shaft q^{18} between the brackets t' and the collar q^{18} is a collar q^{27} having a radially extending arm q^{28}. On the arm r^{10} is a wheel r^{11}. To bring about engagement of the clutch mechanism, to cause the shaft B to be revolved by the drive pulleys, the handle q^5 is turned in the direction of the arrow (Fig. 64), raising the link q^6 and crank q^3 to turn the shaft

q^4 and crank q^5 in the direction of the arrow. The bar q^4 is thus thrust backward turning the bell crank q^5 and drawing down the rod q^6, plate q^7 and rod q^8 to turn the bell crank lever q^9 in the direction which causes it to move the shaft q^{10} toward the side A'. This movement of the shaft q^{10} carries the free end of the arm q^{11} into the path of the wheel B on the end of the arm B^2 which rotates with the fly wheel. The arm q^{11} is formed with a cam edge, as shown in Fig. 61, against which the wheel B^3 strikes, operating to turn the arm q^{11} in the direction of the arrow to a position at the opposite end of the dotted arc in Fig. 61. When the arm arrives at that position it extends beyond the path of the engaging wheel B^3. The turning of the shaft q^{10} by the arm q^{11} turns the worm sleeve q^{20} in the direction which swings the upper end of the stirrup frame q^{21} on its pivot q^{22} in the direction of the fly wheel carrying the collar x^{12} in the same direction, and thus forcing the pins x^{13} into the path of the pins B^5, as before described.

To stop the machine the handle q^3 is turned in the opposite direction to that described, causing the shaft q^{10} to be forced in the direction of the fly-wheel, and carry the arm q^{12} into the path of the wheel x^{23} on the arm x^{24}, whereby the shaft q^{10} and worm q^{20} are turned into the contrary direction to that described, and swing the upper end of the stirrup frame in the direction away from the fly-wheel to move the collar x^{12} and pins x^{13} in the same direction, whereby the pins x^{13} are withdrawn from the path of the pins B^5. The clutch mechanism as described is employed in order that the machinery may always stop when its [fol. 1216] parts are in certain relative positions, as hereinafter described.

On the side frames A^2 A' are corresponding upper and lower brackets p p', respectively, affording supports for the upper and lower ends of guide rods p^2. (See Fig. 40.) The guide rods p^2 pass through the opposite ends of a vertically reciprocating cross-head C and afford guides for the same. On the shaft B toward opposite sides of the machine are eccentrics C", (see Fig. 34,) comprising disks o fixed upon the shaft some distance from their geometric centers. Around the disks o are rings o' carrying rods o^2 pivotally connected at their lower ends with ears o^3 at the opposite ends of the cross-head C. Interposed in the rods

c^2 are the expansion screws c', shown, whereby the rods may be lengthened and shortened at will. The rotation of the disks c within the ring c' gives to the rods c and cross-head C a reciprocal motion in the vertical plane.

Adjustably secured upon the beam A' are four machines, D, for forming and driving staples x, and for feeding strengthening wires y, for purposes hereinafter explained. Any machines which may be employed as attachments for the machine, forming the subject of this application, and which will drive staples and feed a strengthening wire as required may be used in this connection, but the machines shown, and which we prefer to use, are of a construction invented by us, and which forms the subject of Letters Patent of the United States No. 483,254, granted to us September 27, 1892. For a detailed description of the staple forming and driving machines D we refer to the said patent, and only a sufficient description thereof will be attempted in the present application to make clear their functions and operation in the present machine. Each machine D is operated by a reciprocating rod u suitably and adjustably secured at its upper end, as indicated in Fig. 55, to the cross-head C. The staples are made from a wire x', which is fed by intermittent grip mechanism u' across the path of reciprocating wire cutting and staple forming mechanisms, which in the upstroke of the rod u severs the length from the wire and bends it into the form of a staple. At the same time a strengthening wire y is fed by means of intermittent grip mechanism u^2 across an opening through which the staples are discharged. In the downstroke of the operating rod u the staple is engaged by a ram which forces the staple through the said discharge opening into the material to be worked upon hereinafter described in a manner to cause the staple to straddle the strengthening wire y. In each reciprocation of the operating rod u the strengthening wire y is fed forward, as stated, at a speed equal to the velocity at which the material to be operated upon is fed below the staple machine, which in practice may be from one to three inches, or more, as desired. Means are provided in each staple machine for severing the strengthening wires y when material operated upon passes beyond the staplers, and this is done by means of a pivotal switch u^3 (Fig. 56) forming

a part of each stapling machine, and having an operating crank u' provided with a roller u^2, and two cam fingers u^3 u^4. When the switch is rocked to carry the cam face of the finger u^3 into the path of a descending lever which moves with the rod u, cutting mechanism at u^5 is actuated to sever the strengthening wire, and when the switch is rocked to carry the cam finger u^4 into the path of the descending lever mentioned, the strengthening wire cutting mechanism remains at rest. At the top of the rod u is a block or head u^6 having a beveled upper edge u^7 and a loose clamping plate u^8 with a beveled lower edge u^9. The beveled edges u^7 u^9 form a dovetail which fits into a horizontal dovetailed recess u^{10} extending longitudinally in the cross-head C. The plate u^8 is at the end of a set screw u^{11}. The block or head u^6 may be slid along the cross-head C to adjust it in position, and is tightened in place by turning the screw u^{11} to bind the plate u^8 to the cross-head. The beam A is formed at its upper edge with an inclined face u^{12}, and at its lower side with an inclined face u^{13}, the said inclined faces forming a dovetail. On the frame of each staple forming and driving machine D is a lug u^{14} adapted to fit over the face u^{12}, and a lug u^{15} extending over the face u^{13}. In the lug u^{15} is a vertical set screw u^{16} provided at its lower end with a loose beveled block u^{17}, which fits upon the face u^{13}. The staple making and driving machines may be adjusted by sliding them along the beam B, and tightened in position by means of the set screw u^{16}.

At the side A^2 of the machine is a vertical guide opening through which the end of the cross-head C beyond its guide rod l^2 extends. At the opening z the cross-head carries a downward extending bar w carrying a cam plate w', shown in detail in Fig. 43. Extending along the lower forward side of the beam A is a rock shaft l in bearings l' on the said beam. Upon the side A^2 of the machine is a stationary bracket z'. The bracket z' extends through the slot or opening z, and is fastened rigidly against the under side of a bracket z^2 which is fastened against the inner side of of the frame A^2, (see Fig. 34.) Extending through the bracket z' in the direction transversely of the machine, and having its bearings in the said bracket, is a short rock shaft l^2 provided at the outer end of the bracket with an upward

extending arm l', (see Figs. 47 and 48,) and at the inner side of the frame A with a crank l^2. In the plane of the crank l^2 on the end of the shaft l is a crank l^3, (see Fig. 46,) connected at its free end with the end of the crank l^2 by means of a link l^4. The outer end of the rock shaft l is formed with a guide socket l^5, Fig. 48, and in the upper end portion [of 1217] of the arm l' is a guide opening l^6. Parallel with the arm l' is a sliding arm l^7, upon a stud l^8 movable in the socket l^5, and a bearing pin l^9 sliding through the opening l^6. On the end of the pin l^9 at the inner side of the arm l' is a wheel l^{10}. Pivoted between its ends on a pin z^2 passing through the end of an arm of the bracket z' is a handle l^{11} having the angular bifurcated portion l^{12} on one side of its pivot. (See Figs. 50 and 51.) On the side of the sliding arm l^7 opposite its pin l^9 is a circular lug l^{13} having a circumferential recess l^{14}. The forks of the handle l^{11} straddle the lug l^{13} and are provided with screws l^{15}, which extend into the annular groove l^{14}. Movement of the handle l^{11} at the right hand side (Fig. 2) of its pivot in the direction away from the side A moves the bifurcated part l^{12} toward the said side, and causes the sliding arm l^7 to be slid inward with its pins l^9 and l^{13} in the guides l' l^6, to carry the wheel l^{10} into the path of the reciprocating cam a^3. In the subsequent downward movement of the crosshead C the cam a^3 strikes the wheel l^{10} and turns it, the arms l' l^7, the rock shaft l and crank l^2 in the same direction to a limited extent, and causes the crank l^3 and shaft l to be rocked to the left. At opposite end portions of the shaft l are cranks k (see Fig. 49) carrying downward extending pivotal links k', which at their lower ends connect pivotally with collars k^2 fixed to the lower ends of vertical stems k^3 movable in guide openings in the beam A. In the forward face of the beam A is a longitudinal recess k^4 across which the stems k^3 extend. In the said recess is a switch bar k^5 fixed at its opposite ends to the stems k^3. In the forward side of the bar k^5 is a groove k^6 just large enough to receive the wheels a^5 on the ends of the cranks a^4 of the oscillating switches, before described. When the handle l^{11} is turned as described to rock the shaft l, as stated, the stems k^3 are raised and raised the switch bar k^5. In the rise of the bar k^5 the cranks a^4 are swung upward and rock the shafts a^3 in the direction to carry the switch fin-

gers n^2 into the paths of the descending levers carried by the operating tools n of the staple forming and driving devices, causing the severing mechanisms therein to sever the strengthening wires w, as before described. At the end of the shaft l adjacent to the side N of the machine (see Fig. 50) is a crank l^{12}. Extending vertically downward from the bracket l^{7} is a guide rod l^{13} for a sliding collar l^{14} with which the crank l^{12} is pivotally connected at its upper end. On the collar l^{14} is a lug l^{15} carrying a vertical guide pin l^{16} which moves freely through an opening in the plate q^{7}. In line with the pin l^{16} is a guide opening l^{17} through the bracket l^{7} (indicated by dotted lines in Fig. 50), into which the pin l^{16} may move in its rise. When the shaft l is rocked, as before described, to cause the strengthening wire severing mechanisms to operate as stated, it is necessary that the machine shall be stopped temporarily, so that material for a new box blank may be placed in position to be fed forward, as hereinafter described. When the shaft l is rocked, therefore, it swings the crank l^{12} upward, causing the collars l^{14} to be slid upward on the guide rod l^{13}, and causes its lug l^{15} to engage the under side of the plate q^{7} and raise the latter and the rod q to stop the machine, as before described. The pin l^{16} operates merely as a guide, and the openings l^{17} is provided to permit the pin to rise with the collar without obstruction from the bracket l^{7}.

As before stated the box blanks Z (Fig. 65) to be manufactured in the machine comprise sheets Z' of veneering or backing, and cleats Z^{2} which are of a greater width usually than their thickness and of a length equal to that of the blank to be formed. They are secured to the sheets at one edge, as shown.

Mounted in the main frame of the machine is a bed frame E formed with side bars $E'E^{2}$, and cross bars $E\,E^{3}E^{4}$. Between the cross bars $E^{3}E^{4}$ the side bars $E'E^{2}$ are each provided with a downward projecting part i having a horizontal flange with a flat under surface. Bolted against the said flat under surface (see Fig. 8) is a plate i' carrying a vertical downward extending guide pin i^{2}. At the rear ends of the bars $E'E^{2}$ are downward extending parts i^{3} fitting horizontal flanges like the parts i and having flat under faces to which plates i^{4} provided with downward extending guide

pins e are firmly bolted. Extending across the machine from the side A' to the side A^2 between the cross bars E' E^2 is an angle iron beam A^3. At its opposite ends the beam A^3 is formed with tables t^{11} flanked by webs t^{12} t^{13}. The beam is secured to the sides A' A^2 by bolts t^{14} which pass through the webs t^{13}. The guide pins e' extend downward through the upper and lower flanges of the angle iron beam A^3, as shown and the tables t^{11} afford flat horizontal surfaces. Extending between the side frames A' A^2 at the rear end of the machine is an angle iron cross beam A^4 of the same form in cross section as the beam A^3, but facing in the opposite direction. At its opposite ends the beam A^4 is formed with tables t^{15} flanked by webs t^{16} t^{17}; the beam being secured in place by bolts t^{18} passing through the sides A' A^2 and webs t^{17}. Secured against the under surfaces of the plates i' by bolts i^3, which also serve to secure the plates i' to the parts i, are blocks i^2 having extensions i^3 through which the pins e pass, as shown, and provided also with cam faces i^4. Secured to the under surfaces of the plates i^4 by bolts i^{10}, which also serve to secure the said plates to the under surfaces of the parts i, are blocks i^{11} having extensions i^{12} through which the pins i^3 pass, as shown, and cam surfaces i^{13}. The constructions designated by the reference letters i to i^{13} inclusive are exactly similar on opposite sides of the machine. It will be noticed that the cam surfaces i^4 i^{13} in- [fol. 1218] cline in the same direction. Journaled at opposite ends in bearings afforded by the webs t^{13} below the tables t^{11} is a shaft h to which is rigidly secured a bell crank lever h' near the side A', (see Figs. 5 and 9). Extending along the side frames A' A^2 are longitudinally movable rods h^2, provided at opposite ends, respectively, with cam heads h^3 h^4. The cam heads h^3 extend between the cam faces i^4 of the blocks i^2 and the tables t^{11}, and the cam heads h^4 extend between the cam faces i^{13} of the blocks i^{11} and the tables t^{15}. On the rod h^2 is a laterally extending pin h^5 upon a plate h^6 (see Fig. 6) which is clamped to the rod h^2 by a clamping plate h^7 in a manner to grip the rods h^2 firmly between the plates. Along the rod h^2 on opposite sides of the plate h^6 the plate h^7 carries collars h^8 which afford additional gripping surfaces about the rod h^2. A link h^9 is pivotally connected at opposite ends, respectively, to the free end of the upper arm of the bell crank lever h', and the pin h^5. On the shaft h adjacent to the side A' is a crank h^{10} (see Fig. 9)

corresponding in position with the upper arm of the bell crank lever h'. At its upper end the crank h^{10} is pivotally connected to a link h^9 corresponding with the link h^7 described at the other side of the machine, and at its rear end the present link h^7 is pivotally connected to a longitudinally movable rod h^2 at the side A' of the machine in the same way as at the other side, by engagement with a pin h^3 clamped rigidly to the rod, in the same way as shown in Fig. 6 and as described. Extending downward from the beam A^3 is an ear l^{17} from which is pivotally suspended a bearing sleeve l^{15} (Fig. 5) of smooth bore. Pivotally suspended from the lower arm of the bell crank lever h' is an internally threaded sleeve h^{11}. Held in the sleeve l^{15} against longitudinal movement thereon is a threaded shaft h^{12}, which passes through the sleeve h^{11} and engages the threads therein. At the outer end of the sleeve l^{15} the shaft h^{12} is provided with a hand wheel h^{13}. The entire frame E rests at its four corners on the cam heads h^3 h^4, respectively, and the function of the mechanism described is to raise or lower the said bed frame equally at all sides. Turning of the hand wheel h^{13} from right to left causes it to advance the sleeve h^{11} along the shaft h^{12} and swing the lower arm of the bell crank lever h' in the direction to the right in Fig. 5, and the upper arm of the bell-crank lever to the left. The swinging of the bell crank lever as described rocks the shaft h to the left, and the links h^9 are moved longitudinally toward the front of the machine (to the left in Fig. 5), drawing with them the rods h^2. The cam heads h^3 h^4 are also moved with the rods h^2, and by the engagement of their cam faces with the cam faces i^9 i^{10} of the blocks i^7 i^{11}, respectively, force the latter upward equally and raised the bed frame at its four corners. The pins i^8 i^5 move vertically upward in the guides as the bed frame rises and operate to steady the latter and prevent its movement in any but the vertical direction. Turning of the hand wheel h^{13} in the direction opposite to that described moves the parts also in the opposite direction, and permits the bed frame to lower equally at its four corners of its own weight.

Extending longitudinally of the machine and resting upon the cross bars E^3 E^4 and E^5 are parallel cleat guides F F' F^2 F^3. The cleat guides must register with the staple forming and driving devices D, and are adjustably secured in placed upon the bars E^3 E^4 by camps G G' provided upon

each guide bar. The cross bar E^2 is of the form in cross section shown in Fig. 14, having a longitudinal concavity g in its upper face, a beveled edge g' at its rear upper side, a flange g^2 at its forward upper side, and a flat upper surface g^3. On the under surface of each cleat guide bar is a lug g^4 having a beveled projection g^5 adapted to fit against the beveled edge g' of the bar E^2, a rounded portion of ear g^6 which projects into the concavity g affording a bearing for a swinging bracket g^7 carrying a clamp screw g^8, and a flat surface g^9 fitting upon the flat surface g^3 of the cross bar. The swinging bracket g^7 curves over the flange g^2, and the clamp screw g^8 may be tightened against the under surface of the flange g^2 to draw the inclined face g^5 of the lug g^4 against the corresponding face g' on the bar E^2, and thus clamp the cleat guide firmly in place. At the cross bar E^4 each cleat guide is provided with a lug g^{10} having a flat under surface g^{11}, which rests upon the top of the said cross bar. The cross bar E^4 is T-shaped in cross section, as shown in Fig. 14. The lug g^{10} affords a bearing for a pivotal stamp g^{12}, which between its ends has an opening g^{13} (see Fig. 17) through which a clamp screw g^{14} extends. The clamp screw g^{14} at its upper threaded end extends into a threaded socket g^{15} in the under face of the lug g^{10}. On the clamp screw g^{14} are jam nuts g^{16} affording a shoulder which bears against the under surface of the swinging clamp g^{12}. Turning of the screw g^{14} to the right causes the shoulder g^{16} to swing the clamp g^{12} upward to bear at its free end portion against the under surface of the T-head of the bar E^4. The clamping mechanisms G and G′ thus operate to hold the guide bars for the cleats firmly in adjusted position. Each cleat guide is L-shaped in cross section, (as indicated in Fig. 16) having a horizontal flange f, and a vertical flange f'.

As shown in Fig. 3 the guide F has its vertical flange on the left hand side, and all the other guides have their vertical flanges on the right-hand side. So far as the guides F' F^2 are concerned it makes no difference on which side the vertical flanges may be, but it is necessary that the guide F shall have its vertical flange on the left hand side, and the guide F^3 on the right-hand side. The vertical flanges f' of [fol. 1219] the outer guides F F^3 extend upward somewhat higher than those of the intervening guides, as indicated in Fig. 19, for a purpose hereinafter explained.

The object of the guides F F' F^2 F^3 is to guide the cleats in straight lines parallel with each other and longitudinally of the machine in a manner to cause the staple driving machines to drive the staples midway between the sides of the cleats. The side flanges *f'* afford abutments against which the cleats slide at their sides, and they must be so adjusted as to guide the cleats in a manner to cause the staple drivers, which are the first parts adjusted in proper position in the machine, to drive the staples in the centers of the cleats. As for different blanks Z it may be desired to employ cleats Z^2, differing in thickness, the later adjustment of the guides F F' F^2 F^3 is a necessary feature. To shift the guides therefore to the right or left as may be required, their clamping mechanisms G G' may be loosened, and tightened again when the guides have been slid to the positions desired. Different blanks Z will also employ cleats Z^2, which differ in width. By width it is meant the distance between the upper and lower edges of the cleats in Fig. 65. The staple driving mechanisms, while they are laterally adjustable in the cross beam A^3, are in a fixed horizontal plane, and the upper edges of the cleats must be so guided to the staple driving devices as to move the sheet Z' against the under surfaces of the latter. To accomplish this when narrow cleats are employed they must be raised above the horizontal flanges *f* of the guides, so that the sheet will pass over the upper edges of the vertical flanges *f'* of the guides F F^2. To accomplish this on each cleat guide is an angle iron bar H, L-shaped in cross section, (as shown in Figs. 16 and 19) and formed with the upper horizontal flanges f^2 and downward extending vertical flange f^3. The bars H fit over the cleat guides, as shown in the figures mentioned, and are provided near opposite ends with stems f^4 extending downward through openings in the flanges *f* of the guides, and through downward extending guide sleeves f^5 f^6 on under sides of the said cleat guides. The sleeves f^5 f^6 are parts of brackets H' secured to the under surfaces of the cleat guides, as shown in Figs. 14 and 17. On one side of each bracket I is a sleeve bearing f^7 through which extends an adjusting screw f^8. On the adjusting screw at opposite ends of the sleeves f^7 are collars f^9 (Fig. 17) which prevent longitudinal movement of the screw in the sleeve without interfering with its rotation. Extending through the bracket I is a rock shaft f^{10}

carrying at one end a crank f^{11} provided at its lower free end with a pivotal internally threaded sleeve f^{12} into which the adjusting screw f^{7} extends. On the opposite end of the shaft f^{10}, and fixed thereto, is a lever f^{13} (Fig. 14) having an upward extending arm f^{14}, a downward extending arm f^{15}, and a forward extending arm f^{16}. Pivoted to the end of the forward extending arm f^{16} is a downward extending link f^{17}, which at its lower end is pivotally connected to a laterally extending pin f^{18} on the vertical stem f^{4}. Extending between the brackets I I' is a longitudinally movable rod I^{2}. Between the upper surface of the rear portion of the bracket I and the adjacent under surface of the cleat guide is a space f^{19}, and between the upper surface of the forward portion of the bracket I' and the adjacent under surface of the cleat guide is a space f^{20}. The rod I^{2} extends at its opposite ends, respectively, into the said spaces, as indicated most clearly in Fig. 17. On the under surface of the rod I^{2} adjacent to the bracket I is a lug f^{21} having a horizontal guide opening through it, which fits over a backward extending guide stem f^{22} extending from the said bracket parallel with the rod I^{2}. On the under surface of the rod I^{2} adjacent to the bracket I' is a lug f^{23} corresponding with the lug f^{21} and adapted to slide upon a forward extending guide rod f^{24} on the bracket I'. Pivotally connected at one end to the lug f^{23}, and at its opposite end to the arm f^{14} of the lever f^{13}, is a link f^{25}. Pivoted between its ends on the bracket I' is a bell crank liver f^{26}, having a forward and downward extending arm f^{27}, and a backward and downward extending arm f^{28}. A link f^{29} is pivotally connected at one end with the arm f^{27} of the lever f^{26}, and at its opposite end to the lug f^{23} on the rod I^{2}. I link f^{30} is pivotally connected at one end to the arm f^{28} of the bell crank lever f^{26}, and at its opposite end to a pin f^{31}, which extends laterally from the stem f^{4}. Turning of the adjusting screw f^{7} to the right draws the crank f^{11} forward and rocks the shaft f^{10} in the direction to plunge the arm f^{16} upward to raise the stem f^{4} and to plunge the arm f^{14} and through the link f^{25} and rod I^{2} backward to move the link f^{29} in the downward direction, and to swing the arm f^{28} upward to move the stem f^{4} upward by means of the link f^{30}. Thus the stems f^{4} f^{4} are moved simultaneously and

equal distances to raise the bar H equally throughout. On the sides of the bars H are vertical bearings f^{12} for pins f^{13}, (see Fig. 18) carrying horizontal arms f^{14} provided at their ends with wheels f^{15}. Spring f^{16} are housed in the bearings f^{12}, and connected at opposite ends respectively to the pins f^{13} and the bearings. The action of the spring f^{16} is to swing the arm f^{14} in the horizontal direction over the upper surface of the bar H, to cause its wheel f^{15} to bear normally against the vertical flange f'. The wheels f^{15} operate as clamps to hold the cleats Z^2 against the flanges f', as indicated in Fig. 19. The central guides F' F^2 extend to the staple driving machines only, while the outer guides F F^1 extend to the cross bar A^6, as shown in Fig. 3. At the staple driving machines the guides F F^2 are cut away, so as not to interfere with the movement of the clinchers to be next described.

Below each staple and driving machine D is a clincher [fol. 1220] K. Each clincher comprises a frame e affording a sleeve in which is a vertical threaded rod e' provided at its top with an anvil or clinching head e^2. In a horizontal recess across the vertical opening in the sleeve is an adjusting wheel e^3 fastened rigidly to an internally threaded sleeve e^4. At its upper end the sleeve e^4 bears loosely against an annular should e^5 in the frame e, and the threads on the inner surface of the sleeves engage the threads of the rod e'. Turning of the wheel e^3 to the left turns the sleeves e^4 and raises the rod e' and anvil e^2 for purposes of adjustment. Extending upward through the base of the frame e is a set screw e^6 having a head e^7 at its upper end. When the wheel e^3 has been turned to adjust the rod and anvil the set screw e^6 is turned to press the head e^7 against the lower end of the sleeve e^4, and operate as a jam screw to hold the latter against turning. It also operates as a foundation for the sleeves e^4 to relieve the wheel e^3 from shock under the impacts of the staple driving mechanism against the anvil or clincher e^2. At the forward side of each clincher frame e near the top is a lug e^8 having a beveled surface e^9 at its under side, and toward the lower part of its forward side the frame carries a sliding plate e^{10} having a beveled upper surface e^{11}. The surfaces e^9 e^{11} afford a dovetail, and the plate e^{10} is raised by means of a set screw e^{12} extending through the

lower end of the frame. The clinchers K are mounted upon a vertically reciprocating horizontal beam L, having an upper inclined edge e^{13} and a lower inclined edge e^{14}. The beveled edge e^{9} of the frame e is adapted to fit upon the surface e^{13}, and the edge e^{11} of the plate e^{10} against the surface e^{14}. The clinchers may be adjusted laterally into position and tightened in place by turning the screws e^{12} to clamp the plates e^{10} against the surface e^{14}.

At opposite ends of the beam L are webs d beveled at their opposite edges d' to form dovetails, as indicated in Fig. 38. Secured upon the side frames of the machine are guide plates d^2 d^2, which together afford a dovetailed guide recess in which the web portion of the beam slides. On the drive shaft B adjacent to the eccentric C' are eccentrics M, shown in section in Figs. 36 and 37. Each eccentric M is formed with a disk having a cam surface d^3, and a surface d^4 in an arc of which the shaft B is the center. Around the disk is a yoke boxing M' formed with an upper block d^5 and a lower block d^6 secured together by bolts d^7. In the boxing is an annular bearing face d^8 for the disk surface d^4 to slide against, and at the top of the boxing is an opening d^9. Fitting upon the box M' is a block or cross-head M^2 having a central chamber d^{10}. The chamber d^{10} in its upper part contains a roller d^{11} journaled upon a shaft d^{12}, which extends transversely through the cross head, and in the lower part of the chamber d^{10}, and projecting through the opening d^9 of the boxing is a roller d^{13}. The chamber d^{10} is closed at the top by a plate d^{14}. M^3 M^3 are vertical rods secured at their lower ends to the end portions of the beam L and webs d thereon, extending thence upward to a supplemental cross-head M^4 from which rods M^5 extend upward through openings d^{15} in the boxing, and through the cross-heads M^2 and plate d^{14}, being provided above the said plate with nuts d^{16} which rest upon the said plate. The roller d^{13} in each eccentric M rests upon the disk and the roller d^{11} is in contact with the roller d^{13}. In the rotation of the shaft B the cam surface d^3 of the disk engages the roller d^{13} and raises it upon the surface d^4 of the disk, causing it to bear against the roller d^{11} and raise the cross-head M^2. In its rise the cross-head M^2 draws the rols M^5, supplemental cross-head M^4 and rods M^3 upward and slides the beam L upward in the guides d^2.

When the surface d^1 moves past the roller d^{11} the said rollers drop to the reduced cam surface d^2, and the cross-head M^2, rods M^3, cross-head M^1, rods M^4 and beam L drop to their initial positions shown in Figs. 34 and 36. The rise of the beam L plunges the clinchers K upward, and the latter are plunged downward when the beam L is lowered. The eccentrics C' M are so arranged with relation to each other that the operating rods u of the staple forming and driving machines will be plunged downward to drive staples at the same time that the clinchers K are plunged upward; and the rods u will rise as the clinchers descend.

In a horizontal plane below the staple driving devices and at opposite sides of the latter are feed roller shafts N N', journaled at opposite ends in the side bars E' E^2 of the raising and lowering bed frame E. The shafts N N' extend beyond the side A^2 of the machine where they are provided with gear wheels N^2 N^3, respectively. On a shaft N^1 journaled on the side rail E^2 of the bed frame between the shafts N N' are an integral gear N^5 and ratchet wheel N^6. The teeth of the gear N^5 engage the teeth of the gears N^2 N^3. Loosely pivoted upon the shaft N^1 is a bell crank lever N^7 provided at the end of its arm N^8 with a pawl N^9 which engages the ratchet N^6. A rod N^{10} is pivotally connected at its upper end to the reciprocating bar m, before described, and at its lower end to the arm N^{11} of the bell crank lever N^7. In the rise of the cross-head or beam C' and bar m the rod N^{10} is raised swinging the bell crank lever on its pivot and causing the pawl N^9 to turn the ratchet N^6 and gear wheel N^5 to the right. The engagement of the gear N^5 with the gears N^2 N^3 turns the latter and the shafts N N' to the left. On the shaft N are feed rollers N^{12}, and on the shaft N' are feed rollers N^{13}. The feed rollers N^{12} N^{13} are wheels having roughened circumferential faces. The side rails E' E^2 of the raising and lowering bed frame are provided in their upper surfaces with recesses e.

P is a sliding frame which is operated by hand as hereinafter explained, its function being to feed the sheets Z' [fol. 1221] and cleats Z^2 forward initially until they are engaged and advanced by the feed rollers of the machine. The frame P is formed with two side bars P' P^2, and a cross bar P^3. The cross bar P^3 is L-shaped in cross sec-

tion (see, for example, Fig. 22) and is bolted at opposite ends to flanges *b* of the side bars P″ P⁴. On the side bars E′ E³ of the raising and lowering bed frame are standards E⁵ E⁶, respectively, and journaled at opposite end portions in the tops of the said standards is a shaft E⁷. Beyond the standard E⁵ and the shaft E⁷ carries a gear wheel E⁸. Journaled in the standard E⁸ is a short shaft E¹⁰, carrying a pinion E¹¹ engaging the gear wheel E⁸, and at the outer end of the shaft E¹⁰ is a hand wheel E¹². On the shaft E⁷ adjacent to the standard E⁵ is a sleeve E¹³ which is keyed or otherwise secured to the shaft. On the sleeve E¹³ is a lug E¹⁴ (see Fig. 22). Surrounding the sleeve E¹³ is a loose collar E¹⁵ having an arm E¹⁶. The collar E¹⁵ is cut away, as shown in Fig. 22, to form a recess E¹⁷ with stops E¹⁸ E¹⁹ at opposite ends. The lug E¹⁴ plays in the recess E¹⁷ of the collar E¹⁵ between the stops E¹⁸ and E¹⁹. At its free end the arm E¹⁶ is pivotally connected to one end of a link E²⁰, which at its opposite end is pivotally connected to an ear E²¹ on the side bar P⁴. Adjacent to the standard E⁶ on the side bar P″ of the sliding frame is a sleeve E²² which corresponds with the sleeve E¹³ at the other end of the shaft E⁷. The sleeve E²² is secured to the shaft by a set screw E²³, see Fig. 27. On the sleeve E²² is a radial arm E²⁴, which corresponds with the lug E¹⁴ on the sleeve E¹³. Surrounding the sleeve E²² is a loose collar E²⁵ having an arm E²⁶, and the collar is recessed in the same way as the collar E¹⁵ to afford the stops E²⁷ E²⁸, as shown in Fig. 29 the stops corresponding with the stops E¹⁸ and E¹⁹ on the collar E¹⁵. The arm E²⁴ on the sleeve E²² plays between the stops E²⁷ E²⁸. The arm E²⁶ is pivotally connected at its free end to a link E²⁹, which at its opposite ends is pivotally connected to an ear E³⁰ on the side bar P″, see Fig. 1.

Extending longitudinally of the cross bar P³ is a shaft R mounted in bearings afforded by webs P⁵ at the ends of the bar P³ and bolted to the flanges *b*. On the end of the shaft R adjacent to the standard E⁷ is a crank R′ provided with a pin R², as shown in Fig. 28. Surrounding the sleeve E²² at the standard E⁷ is a yoke R³ having an inner circumferential face which fits loosely over the outer circumferential surface of the sleeve. At the upper side of the yoke is a yoke or cross-head R⁴ on the ends of rods R⁵ which pass loosely through openings in opposite sides of the yoke R³

and extend to a yoke R^5. Between the rods R^4 and yoke R^5 is pivoted to the pin R^6 of the crank R'. On the side of the yoke or cross head R^5 is a projection R^7 with a cam edge R^8. The face of the projection R^7 is just out of the path of the arm E^{24} on the sleeve E^{22}, and near the free end of the arm E^{24} is a roller E^{25} which as the shaft E^8 is turned glides across the cam edge R^8 in the path of the dotted arc in Fig. 25, and by its engagement with the said cam edge forces the cross head R^5 to the yoke R^4 and moves the rods R^4 to turn the crank R' and shaft R a limited distance. The cross bar P^3 presents a smooth vertical rear surface against which fits a vertical sliding plate R^9, (see Figs. 19 and 20) extending nearly the full length of the bar P^3. On the rear face of the plate R^9 are longitudinal ridges R^{10} R^{10}, which together form a dovetailed projection. At opposite end portions of the rear face of the plate R^9 are ears R^{11}, and at the forward upper edge of the plate R^9 is a horizontal longitudinally extending flange R^{12}, which overlaps the upper edge of the bar P^3. In opposite end portions of the bar P^3 are vertical guide openings P^4, (see Fig. 24) and coincident with the said openings are downward extending pins R^{13} on the flange R^{12} of the plate R^9. The pins R^{13} slide up and down in the openings P^4 to guide the plate R^9 and maintain it against the rear face of the bar P^3. In the bar P^3 directly forward of the openings P^4 are vertical sockets P^5 containing vertically movable headed studs P^6. Confined between the heads of the studs P^6 and the bases of the sockets P^5 are springs P^7, which tend to maintain the studs P^6 at their upper limits. Journaled at opposite ends in the webs P^8 is a shaft S, which extends parallel with the shaft R. On the shaft S adjacent to the webs P^8 are backward extending fingers S' having at their free ends straight under surfaces S^2 which rest upon the heads of the pins P^6 and cam shaped upper surfaces S^3. Keyed to the shaft R at the fingers S' are collars S^4 provided with cam projections S^5 having the cam surfaces S^6 S^7 and a short arm S^8. Links R^{14} are pivotally connected at their upper ends to the arms S^8, and at their lower ends to the ears R^{11} on the plate R^9. The cam surfaces S^6 of the projections S^5 are normally in engagement with the cam surfaces S^3 of the fingers S', as shown in Fig. 24, the fingers operating to hold the shaft R against being rocked except

by power applied to the crank R', as hereinafter described.

Fastened adjustably on the rear face of the plate R^3 are spear-holders T, shown in vertical section in Fig. 21. On the forward side of each holder T is a lug T' having a beveled upper face, and a clamping plate T^2 having a beveled under face. The said beveled faces form a dovetailed groove between them, to fit over and engage the dovetailed ridges R^{10} on the plate R^3. The clamping plate T^2 is upon a threaded pin T^3 and may be tightened and loosened by the turning of a thumb nut T^4. When the clamping plate is loosened the holder T may be slid along the plate R^3 to any desired position and may be fastened rigidly in place by tightening the clamping plate T^2 again. Hinged to the lower end of each holder T is a socket-piece T^5 held normally against a stop T^6 by a spring T^7. The socket-piece [fol. 1222] extends normally downward in line with the holder T and is prevented from swinging forward from that position by the stop T^6. It may, however, swing in the backward direction against the resistance of the spring T^7. In the socket of the socket-piece T^5 is a downward projecting sharp pointed pin or spear T^8, fastened in place by a set screw T^9.

Pivoted upon the shaft S near opposite ends of the latter, as shown in Figs. 3 and 20, are arms V V provided at their upper ends with fingers V', which extend backward for a distance in a straight line as shown, and curve thence downward. Secured at opposite ends by set screws V^2 to the free ends of the fingers is a horizontal rod V^3, which extends parallel with the shaft S. On the rod V^3 are socket pieces or holders V^4 which are adjustable along the rod and are provided with set screws V^5 for securing them in adjusted position. Secured by set screws V^6 in the sockets of the holders V^4 are pins or stops V^7. On the top of each finger V' is a block V^8 having an elongated opening V^9 extending at an angle to the finger and receiving the shaft E^3, as shown in Fig. 20. The block V^8 affords a cam loop for the purpose hereinafter described.

Surrounding the sleeve E^{23} and confined between a collar E^{24} and the yoke R^4 is a yoke E^{25} having guide openings E^{26} on opposite sides for longitudinally reciprocating rods E^{28}. The rods E^{28} at their opposite ends are secured in a yoke E^{29} which loosely surrounds the shaft R. Above

the yoke E^{33} on the rods E^{35} are adjusting nuts E^{37} and jam nuts E^{38}, see Fig. 26. The yokes E^{33} E^{36} and rods E^{35} prevent separation of the shafts E^5 R for a greater distance than that desired in the forward and backward movement of the sliding frame P as hereinafter described. By turning the nuts E^{37} to decrease the distance to which the shafts E^5 R may separate the cross head R^1 is permitted to separate itself a greater distance from the yoke R^3, and thus increase the distance of plunge of the rods R^5 under the engagement of the wheel E^{31} with the cam R^6, and thus further increase the distance to which the shaft R will be rocked to plunge the spears into the material Z' Z^2. Turning of the adjusting nuts E^{37} to increase the distance which the shafts E^5 R may separate decreases the distance which the cross head R^1 may separate from the yoke R^3, and consequently the distance of movement of the rods R^5 under the engagement of the wheel E^{31} with the cam R^6, causing the spears T^8 to be plunged a shorter distance into the material Z' Z^2 by the more limited rocking of the shaft R.

Secured by bolts P^9 passing through boltholes P^{10} in the webs P^8 of the bar P^2 are backward and downward extending arms P^{11} affording at their free ends bearings for the opposite ends of a guide roller P^{12} below the bar P^2, see Fig. 20.

On the side bars E' E^2 of the raising and lowering bed frame are brackets W (see Fig. 12), provided at their upper ends with sleeves W' threaded internally at their upper end portions. Fitting into the tops of the sleeves W' are hollow adjusting screws W^2. Working in each sleeve W' is a plunger W^3 having a head portion W^4 at its lower end, and a stem W^5 which extends upward through the sleeve and the hollow screw W^2. In each sleeve W' confined between the plunger head W^4 and the adjusting screw W^2 is a spring W^6. On the stem W^5 above the screw W^2 are jamb nuts W^7. Four brackets W with their plungers W^4 are provided upon the machines, two at each side placed coincidentally, as shown in Fig. 3. The plungers W^4 at their lower end portions afford bearings for two transverse guide rollers W^8 W^9, respectively, which extend above and parallel with the shafts N N', respectively, which have been before described.

The side bars P' P^2 of the sliding frame P are angular in cross section, as shown, for example in Fig. 12, to afford

longitudinal recesses b' which extend from the flanges b to the rear ends of the said side bars, see Fig. 23. The bases of the recesses b' of the side bars P' P^2, respectively, have coincident surfaces formed in steps b^2 b^3 b^4. The steps b^2 are the lowest, the steps b^3 slightly higher than the steps or surfaces b^2, and the steps or surfaces b^4 in a plane slightly higher than the steps or surfaces b^3. Between the surfaces b^2 and b^3 are abrupt cam surfaces b^5; and between the surfaces b^3 b^4 are abrupt cam surfaces b^6. The roller W^8 is provided at opposite ends with wheels or pulleys W^{10}, and the roller W^9 is provided at opposite ends with wheels or pulleys W^{11}. The wheels W^{10} and W^{11} of the rollers W^8 W^9 rest in the recesses b' of the side bars P' P^2, being held down to the bases of the latter by the springs W^6.

The operation is as follows: Assuming for example that the boxes for which the blanks Z are intended are to be three feet in length and two feet square in cross section, that is to say in width and depth outside measurement, the blanks must be eight feet long and three feet wide. In other words, the strips of backing forming the sheet Z' must be three feet in length and the cleats Z^2 eight feet in length. We will assume further that the cleats are each two inches in width, and the backing material Z' one-eighth of an inch in thickness. To adjust the machine for making blanks of the said dimensions and sizes of material, the staple drivers and formers D are slid along the beams C, A^3, and tightened in position, as before described, with their staple discharge openings about one foot apart. The cleat guide bars are then adjusted along the supporting cross bars E^3 E^4 E^5 and tightened in place by means of the clamps G G' to register with the staple driving machines, and extend with their upper projecting flanges f' slightly to one side of the plane of the staple discharge openings in the said machines. [fol. 1223] When adjusted, the side guides F F^3 will be just far enough apart to permit the lengths of backing or veneering Z' to extend between the respective flanges f', as indicated in Fig. 19. As shown in the said figure the flanges f' of the guides F F^3 project upward a distance slightly in excess of the flanges f' of the guides F' F^2, so that the strips of backing will rest upon the flanges f' of the two central guides F' F^2 and extend at their ends loosely against the flanges f' of the guides F F^3,

whereby the latter flanges afford guides for the ends of the strips Z'. The bed frame E is then adjusted by turning the hand wheel h^{13} to raise it or lower it, so that the tops of the flanges f' of the guides F' F^2 will extend in a plane one-eighth of an inch (the thickness of the backing) below the plane of the under surfaces of the staple driving machines. The tops of the feed rollers carried by the shafts N' N^2 are in the plane of the tops of the central flanges f', and being mounted upon the bed frame E will be adjusted by the movement of the latter. The angle iron bar H on the cleat guides are then adjusted by turning the hand wheels f^5 to raise or lower them to a plane two inches (the width of the cleats Z^2) below the plane of the tops of the central guide flanges f'. The clinchers K are then adjusted by turning their adjusting wheels c^3, so that when raised by the operating beam L they will reach a plane exactly two and one-eighth inches below the under surfaces of the staple forming and driving machines. The stops V^7 with their holders V^6 are then adjusted along the rod V^5, so as to extend above the cleat guides close to the flanges f'. When these adjustments have been made the machine is ready for operation. Cleats Z^2 are slid along the upper surfaces of the angle bars H between the clamping wheels f^{15} and flanges f' to the stops V^7, as shown in Fig. 20, and strips of backing or veneering are placed upon the cleats between the guide flanges f' of the bars F F^2, as shown in Figs. 4, 19 and 20. The guide roller p^{12} bears upon the upper surface of the backing to hold the latter down upon the cleats and flatten it out should it be warped. When the cleats and backing have been placed in position, as described, it has to be fed forward to the guide rollers W' N^{12}, and this is done by the sliding frame P in the following manner: The operator turns the hand wheel E^{12} to the left, causing the pinion[11] to turn the shaft E^5 and the sleeve E^{13} E^{22} carried thereby to the right in Fig. 2. In the initial movement of the shaft and sleeves the lug E^{14} on the sleeve E^{13} moves in the collar E^{15} from the stop E^{17} to the stop E^{18} without turning the arm E^{16}; and the arm E^{24} on the sleeve E^{22} moves in the collar E^{25} from the stop E^{28} to the stop E^{27} without turning the arm E^{26}. In this initial movement of the shaft while the arm E^{24} is moving between the stops E^{28} E^{27} the wheel E^{31} on the arm E^{24} is swung in the path of the dotted

are in Fig. 25, causing it to engage the cam edge R^5 on the crosshead R^4 and move the latter to the yoke R^3, and by means of the rods R^2 and yoke R^6 move the crank R' to rock the shaft R. As the shaft R is turned the arms S^5 on the collars S^4 are rocked downward and through the links R^{14} press the sliding bar R^9 downward to force the pointel pins or spears T^5 through the backing Z' and into the cleats Z^2. At the same time the cam projections S^6 are caused to wipe across the cam surfaces S^8 of the fingers S', depressing the latter against the resistance of the springs P^7, until the points of the cam projections pass across the said cam surfaces S^8 when the surfaces S^7 of the cam projections S^6 will be engaged by the upper surfaces of the fingers S' and the rock shaft R will be held by their engagement. The object of the cam projections S^6 and spring operated fingers S' is to hold the shaft R against rocking except by the action of the wheel E^{31} against the cam R^5. The engagement of the spears T^5 with the backing and cleats causes the latter to be firmly gripped by the sliding frame. To prevent the sliding frame from being raised while the spears are being pressed into the material Z' Z^2, stops E^{39} are provided upon the side bars E' E^2, having lugs E^{40}. The stops E^{39} limit the forward movement of the sliding frame P and the lugs E^{40} extend over the forward edge of the cross bar P^3 to prevent the latter and frame P from being lifted, as indicated in Fig. 2. At the moment that the spears have been plunged the full distance downward the arm E^{24} engages the stop E^{27} on the collar E^{25} and the lug E^{11} engages the stop E^{28}, so that in the further turning of the shaft E^8 the arms E^{10} E^{26} will be swung downward and backward and move the sliding frame in the backward direction. As the frame is moved in the backward direction the engagement of the guide loops V^9 with the shaft E^8 causes the fingers to be raised, the arms V swinging on the pivots afforded by the shaft S. By the rise of the fingers V' the rod V^3 and stops V^7 are raised to move the latter out of the path of the cleats Z^2 and backing Z'. As the sliding frame is moved backward the side bars P' P^2 are slid in the recesses *c* of the side bars E' E^2 of the raising and lowering bed frame. At the moment that the initial ends of the cleats Z^2 and backing Z' reach the feed rolls X^{12} and upper feed roller W^5, the cams b^6 engage the wheels W^{10} on the roller W^5, and the cams b^5 engage the wheels W^{11} on the rollers W^9, and raise the latter

slightly against the resistance of the springs W^6, the roller W^5 being thus lifted, the backing Z' may pass freely under it to the staple driving and forming machines. When the initial end of the material Z' Z^2 reaches the staple driving and forming mechanisms the machine is set in motion. This is accomplished, as before described, by turning the lever of handle q^5 to the right in Fig. 2, to produce engagement [fol. 1224] of the clutch members on the drive shaft B. In the first turning of the drive shaft B the operating rods a of the stapling machines are plunged downward to drive staples already formed through the backing Z' and into the cleats Z^2 over the strengthening wires y. In the downstrokes of the operating rod a the clinchers K are raised against the under surfaces of the cleats, as before described, to receive the impact of the staple drivers. After the first staples have been driven the hand wheel E^{12} is given a further turn to move the cleats and backing to the feed rollers N^{13} W^6. While the next staples are being driven the hand wheel E^{12} is turned to the right (in Fig. 2) or in the direction to move the sliding frame P forward to its initial position. In the first movement of the shaft E^5 the lug E^{21} on the sleeve E^{23} is turned from the stop E^{25} to the stop E^{26}, and the arm E^{24} is turned from the stop E^{27} to the stop E^{28}. In the movement of the arm E^{24} the wheel E^{29} is moved across the cam edge R^5. It should be mentioned here that in the movement of the sliding frame between its initial and final positions it passes under the shaft E^5 causing the rods R^3 to be moved longitudinally upward and then downward through the guide openings R^4, the shaft R in the meantime being held against rocking by the engagement of the cam S^5 with the fingers S', as before described. When the sliding frame is at the backward limit of its movement the rods R^3 extend backward and downward from the shaft E^5 instead of forward and downward, as shown in Fig. 25, but at about the same angle to the vertical plane as that there shown. As the shaft E^5 is turned as before described to carry the wheel E^{29} across the cam surface R^5, in the movement of the hand wheel E^{12} to the right, the cross head R^1 is moved to the yoke R^2 and the crank R' and shaft R are rocked in the direction contrary to that at first described. In other words, as viewed in Figs. 20 and 22, the shaft R is rocked from right to left to raise the arms S^5 and sliding plates R^6 and withdraw the spears T^5 from

the material Z' Z² and wipe the cam projection S⁵ across the fingers S', so that the parts named will be in the relative positions shown in Fig. 20. In the further turning of the hand wheel E¹² the lug E¹⁴ engages the stop E²⁶, and the arm E¹⁵ engages the stop E²⁵, to slide the frame P in the forward direction. The hand wheel E¹² is turned, as stated, until the cam surfaces b^6 b^5 in the recesses b cross the feed roller wheels W¹⁰ W¹¹, respectively, to permit the feed rollers W⁵ W⁶ to drop upon the upper surface of the backing and clamp the latter against the feed rollers N¹² N¹³. The sliding frame is moved backward no farther than this, which is about half way to its initial position, in order to maintain the lower ends of the stops V⁷ above the surface of the backing Z'.

In every down-stroke of the staple machine operating bars n staples are driven as described, and with every up-stroke thereof to form new staples the bell crank lever N⁷ is swung upward to cause the pawl N⁹ to turn the ratchet wheel N⁸ and gear N⁵ to rotate the gears N² N³ and turn the feed rollers N¹² N¹³ to advance the material Z' Z². At the same time strengthening wires y are drawn through the stapling machines by the forward movement of the material Z' Z². The feed mechanism for the material Z' Z² is rendered readily adjustable by causing the operating rod N¹⁰ to be pivotally connected to the arm N¹¹ of the bell crank lever N⁷ at an elongated slot x^3 (Fig. 2), and in which it may be moved and tightened at will to increase or diminish the distance of throw of the pawl N⁹. When the end of the material Z' Z² reaches the staple driving mechanisms, and the final staples are driven it is necessary to sever the strengthening wires, feed them forward a short distance, and then stop the machine until material for a new blank Z is placed therein. As the final staples are being driven the operator turns the handle l^{13} to move the wheel l^{12} into the path of the descending cam m'. The engagement of the cam m' with the wheel l^{12} causes the shaft l to be rocked, as before described, to raise the switch bar k^4 and move the switch fingers n^6 into the paths of the descending levers, before referred to, in the staple driving machines. The rocking of the shaft l also causes the rods q^{23} to be plunged upward, as before stated, to move the arm q^{28} into the path of the wheel r^{11} carried by the arm n^{10}, whereby the arm q^{27} and rock shaft p^{15} are turned to swing

the yoke q^{5} and disengage the clutch mechanism. The relative positions of the wheel r^{11} and arm q^{7} are such that the latter is turned to produce disengagement of the clutch just as the operating rods a reach the limit of their upstroke, and when the clutch members disengage, the operating shaft B ceases immediately to rotate. In the final movements of the operating rods a the strengthening wires are severed and fed forward the distance of an inch, or thereabout, to afford the projecting ends shown in Fig. 65.

The wires x', from which the staples are formed, and the strengthening wires a are upon spools a a', respectively, which revolve upon shaft a^{2} a^{3}, (see Fig. 32) journaled at opposite ends in brackets a^{4}. The brackets a^{4} are supported upon a cross bar A^{7} which extends between brackets A^{8} on the side frames A' A^{2}. Each bracket a^{4} extends across the supporting bar A^{7}, the bearings for the shafts of the spools a a' being respectively on opposite sides of the bar A^{7}. The bar A^{7} is provided midway between its side edges with a slot A^{9} which extends nearly the full length of the said bar. Each bracket a^{4} is upon a base plate a^{5}, which fits longitudinally upon the supporting bar A^{7}, and is provided with a slot a^{6} which registers with the slot A^{9} in the supporting bar. The bearings for the shafts a^{2} are in recesses a^{7} in the sides of the brackets, as shown in Figs. 31 and 33, and the base plates a^{5} are adjustably secured in position upon the [fol. 1225] bar A^{7} by means of nut bolts a^{8} which pass through the slot a^{6} A^{9} (see Fig. 32). On the brackets a^{4} are ears a^{9} which afford bearings for shafts a^{10} which extend parallel with the shafts a^{2}. On each shaft a^{10} is a sleeve a^{11} provided with arms a^{12} between which is mounted a sheave a^{13}. Midway of the sheave a^{13} on each sleeve a^{11} is an upward extending finger a^{14} provided with an eye a^{15}. Each sleeve also carries a lug a^{16} which rests upon a spring stud a^{17} housed in the bracket. On each sleeve are two lugs a^{18} which are pressed against the flanges of the spools a a' by the action of the spring studs a^{17} to operate as brakes upon the spools. The wires carried by the spools extend through the eyes a^{15} and over the sheaves a^{13} down through the coincident slots a^{6} A^{9} to the staple forming and driving machines. When the intermittent grip mechanisms of those machines engage the wires to feed them forward they draw down upon the wires causing them to bear upon the sheaves a^{13}, and swing the arms A^{10} downward to turn the sleeves a^{11}

to raise the lugs a^{17} from engagement with the spools. Thus while the intermittent grip mechanisms are drawing upon the wires the spools will revolve freely, but just as soon as the intermittent grip mechanisms cease to draw upon the wires the latter cease to draw upon the sheaves a^{12}, whereby the spring studs a^{16} press the lugs or brakes a^{17} against the spools and prevent their rotation to pay out the wire. In this way the tugs upon the wires produced by the intermittent grip mechanisms will not cause the spools to revolve any more than is necessary to pay out the wires as they are drawn by the intermittent grip mechanisms. Were it not for the brake mechanisms the spools might be so revolved on their bearings when a tug is given to the wires as to pay out more wire than is desired and permit the wires to become tangled between the spools and the intermittent grip mechanisms.

As explained at length in our aforesaid Letters Patent the intermittent grip mechanisms a^2 are only operated to feed forward strengthening wires when the latter are cut. While material for blanks Z is being advanced under the stapling machines, the wires a are drawn through the stapling machines from their spools a^3, and require no other feed. When the wires a are severed they have to be advanced across the under surfaces of the stapling machines to afford the projecting ends mentioned, and the switch mechanism brings into action the cutters, which sever the wire and also operate the intermittent grip mechanism a^2. This construction belongs to the stapling machines and is therefore not shown more in detail in the present connection.

While we prefer to construct the machine as shown and described it may be modified with respect to details without departing from the spirit of our invention as defined by the claims.

What we claim as new, and desire to secure by Letters Patent, is—

1. In a machine for forming box blanks by fastening sheets and strengthening wires to reinforcing cleats, the combination of guides for the cleats, intermittent feed mechanism for advancing the cleats longitudinally in their guides and with a sheet through the machine, an intermittingly actuated staple driver adjacent to the path of each cleat, alter-

nating in its action with said feed mechanism, to fasten the sheet, by successive operations, to the cleat, and means for guiding strengthening wires with the cleats and sheet across the staple drivers, substantially as and for the purpose set forth.

2. In a machine for forming box blanks by fastening sheets and strengthening wires to reinforcing cleats, the combination of outer and intermediate guides for the cleats, intermittent feed mechanism for advancing the cleats longitudinally in said guides with a sheet through the machine, an intermittingly-actuated staple driver adjacent to the path of each cleat alternating in its action with said feed mechanism to fasten the sheet and strengthening wires by successive operations to the cleat at intervals in the direction longitudinally of the cleat, and means for guiding strengthening wires with the sheet across the staple drivers, substantially as described.

3. In a machine for forming box blanks by fastening sheets and strengthening wires to reinforcing cleats, the combination of guides for the cleats, intermittent feed mechanism for advancing the cleats longitudinally in their guides and with a sheet through the machine, an intermittingly actuated staple driver above the path of each cleat, alternating in its action with said feed mechanism, to fasten the sheet, by successive operations, to the cleat at intervals in the direction longitudinally of the cleat means for guiding strengthening wires with the sheet across the staple drivers, and reciprocating clinchers below the paths of the said cleats co-operating with the staple drivers, substantially as described.

4. In a machine for forming box blanks by fastening sheets and strengthening wires to reinforcing cleats, the combination of guides for the cleats, intermittent feed mechanism for advancing the cleats longitudinally in their guides and with a sheet through the machine, an intermittingly actuated staple driver above the path of each cleat, an intermittingly actuated clincher below the path of each cleat, the said staple drivers and clinchers being adjustable with relation to each other and co-operating in their action to alternate with the said feed mechanism to fasten the

sheet, by successive operations, to the cleats at intervals in the direction longitudinally of the cleats and means for guiding strengthening wires with the sheet across the staple drivers, substantially as described.

5. In a machine for forming box blanks by fastening sheets and strengthening wires to reinforcing cleats, the [fol. 1226] combination of laterally adjustable guides for the cleats, intermittent feed mechanism for advancing the cleats longitudinally in their guides and with a sheet through the machine, a laterally adjustable intermittingly actuated staple driver adjacent to the path of each cleat, alternating in its action with said feed mechanism, to fasten the sheet, by successive operations, to the cleat at intervals in the direction longitudinally of the cleat and means adjustable with the staple drivers for guiding strengthening wires with the sheet across the staple drivers, substantially as and for the purpose set forth.

6. In a machine for forming box blanks by fastening sheets and strengthening wires to reinforcing cleats, the combination of guides for the cleats, intermittent feed mechanism for advancing the cleats longitudinally in their guides and with a sheet through the machine, an intermittingly actuated staple driver and a guide for a strengthening wire adjacent to the path of each cleat, the staple drivers alternating in their action with the said feed mechanism to fasten the strengthening wires and sheet, by successive operations, to the cleat at intervals in the direction longitudinally of the cleat, substantially as described.

7. In a machine for forming box blanks by fastening sheets and strengthening wires to reinforcing cleats, the combination with intermittingly actuated staple drivers, of guides for the lateral edges of the sheet, guides for cleats intermediate of the said sheet-guides, guides for strengthening wires at the staple drivers and intermittent feed mechanism alternating in its action with the said staple drivers for advancing the cleats and sheets in their guides with the strengthening wires across the said staple drivers, substantially as and for the purpose set forth.

8. In a machine for forming box blanks by fastening sheets and strengthening wires to reinforcing cleats, the combination of intermittent feed mechanism for advancing the cleats longitudinally with a sheet through the machine, an intermittingly actuated staple driver adjacent to the path of each cleat, alternating in its action with said feed mechanism, to fasten the strengthening wires and sheet, by successive operations, to the cleat at intervals in the direction longitudinally of the cleat a strengthening wire guide at each staple driver, guides for the lateral edges of the sheet and guides for the cleats adjustable with relation to the said sheet guides according to the width of the cleats and thickness of the sheet, substantially as and for the purpose set forth.

9. In a machine for forming box blanks by fastening sheets and strengthening wires to reinforcing cleats, the combination of an adjustable bed frame, mounted in guides with means for raising and lowering it therein guides for the cleats on the said bed frame, intermittent feed mechanism for advancing the cleats longitudinally with the sheet through said guides, and intermittingly actuated staple driver adjacent to the path of each cleat alternating in its action with said feed mechanism, to fasten the strengthening wires and sheet, by successive operations, to the cleat at intervals in the direction longitudinally of the cleat and a strengthening wire guide at each staple driver, substantially as and for the purpose set forth.

10. In a machine for forming box blanks by fastening sheets and strengthening wires to reinforcing cleats, the combination with the intermittingly actuated staple drivers, of guides for the cleats, guides for the strengthening wires and intermittingly actuated feed rollers for advancing the sheet strengthening wires and cleats in their guides longitudinally across the said staple drivers, the said feed rollers alternating in their action with the said staple drivers, substantially as described.

11. In a machine for forming box blanks by fastening sheets to reinforcing cleats, the combination with intermittingly actuated staple drivers, of guides for the sheet and cleats, intermittent feed rolls, alternating in their action

with the said staple drivers to advance the sheet and cleats in their guides longitudinally across the staple drivers, and a sliding frame, provided with means for gripping the cleats through the sheets, and operative to engage the same, when initially fed to the machine, slide them to the said feed rolls, hold them together until the first staples are driven and then release them, substantially as described.

12. In a machine for forming box blanks by fastening sheets and strengthening wires to reinforcing cleats, the combination of guides for the cleats, intermittent feed mechanism for advancing the cleats longitudinally with a sheet through the machine, a series of intermittingly actuated staple forming and driving machines, alternating in their action with the said feed mechanism, disposed above the path of the sheet and cleats and in a horizontal line at right-angles to said path, and means for guiding strengthening wires across the staple drivers, whereby the strengthening wires and sheet, by successive operations of the staple drivers, are fastened to the cleats at intervals in the direction longitudinally of the cleats, substantially as described.

13. In a machine for forming box blanks by fastening sheets and strengthening wires to reinforcing cleats, the combination of guides for the cleats, intermittent feed mechanism for advancing the cleats longitudinally with a sheet through the machine, an intermittingly actuated staple driver adjacent to the path of each cleat, alternating in its action with said feed mechanism, and means for severing and initially advancing a strengthening wire across each staple driver before the first staple is driven into a cleat, substantially as and for the purpose set forth.

14. The combination with the main-frame, of a driver [fols. 1227 & 1228] and drive-shaft mounted thereon, clutch mechanism between the said driver and shaft shipping-mechanism on the frame for engaging and releasing the clutch members to start and stop the machine, staple forming and driving machines mounted on the frame and actuated from the said drive-shaft, guides at said staple machines for strengthening wires *y*, strengthening wire engaging and advancing means, and strengthening-wire severing means at the said guides normally inactive and

brought into action by movement of said shipping mechanism, to disengage the said clutch-members, and a feed for the material to be stapled actuated from the said drive-shaft to advance the material intermittingly across the said staple machines, substantially as described.

15. In a machine of the character described, the combination with the main-frame, drive-shaft, staple forming and driving machines mounted on the frame and actuated from the drive-shaft, strengthening-wire guides, and intermittent feed for the material to be stapled, of rotary spools on the main frame for the strengthening wires *a* and staple-wires *x*, and brakes for the said spools engaged by said wires and operating when the wires are at rest normally to engage the spools, and under pressure against them exerted by the wires when drawn upon, to release the spools substantially as and for the purpose set forth.

Thurston L. Knudtson, Jacob Uhri.

In presence of M. J. Frost, W. N. Williams.

(Here follow side folios 1229 1232.)

[fol. 1233] United States Patent Office.

Charles S. Jonas and Richard A. Jonas, of Brooklyn, New York

Wire-stitching Machine

Specification Forming Part of Letters Patent No. 538,021, Dated April 23, 1895

Application filed October 3, 1892. Serial No. 447,683. (No model.)

To all whom it may concern:

Be it known that we, Charles S. Jonas and Richard A. Jonas, citizens of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented new and useful Improvements in Wire Stitching Machines, of which the following is a specification.

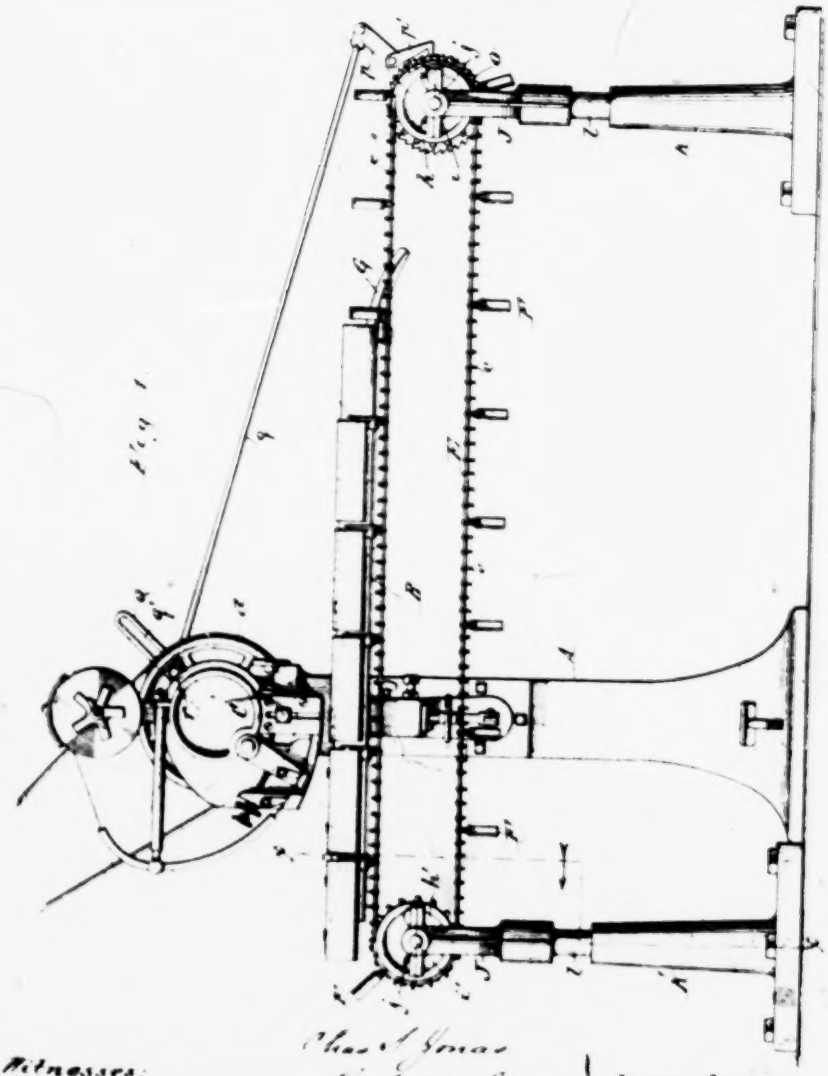
(No Model.)

2 Sheets—Sheet 1.

C. S. & R. A. JONAS

WIRE STITCHING MACHINE.

No. 538,021. Patented Apr. 23, 1895.



Witnesses:
Theo L. Popp
Chas. F. Burkhardt

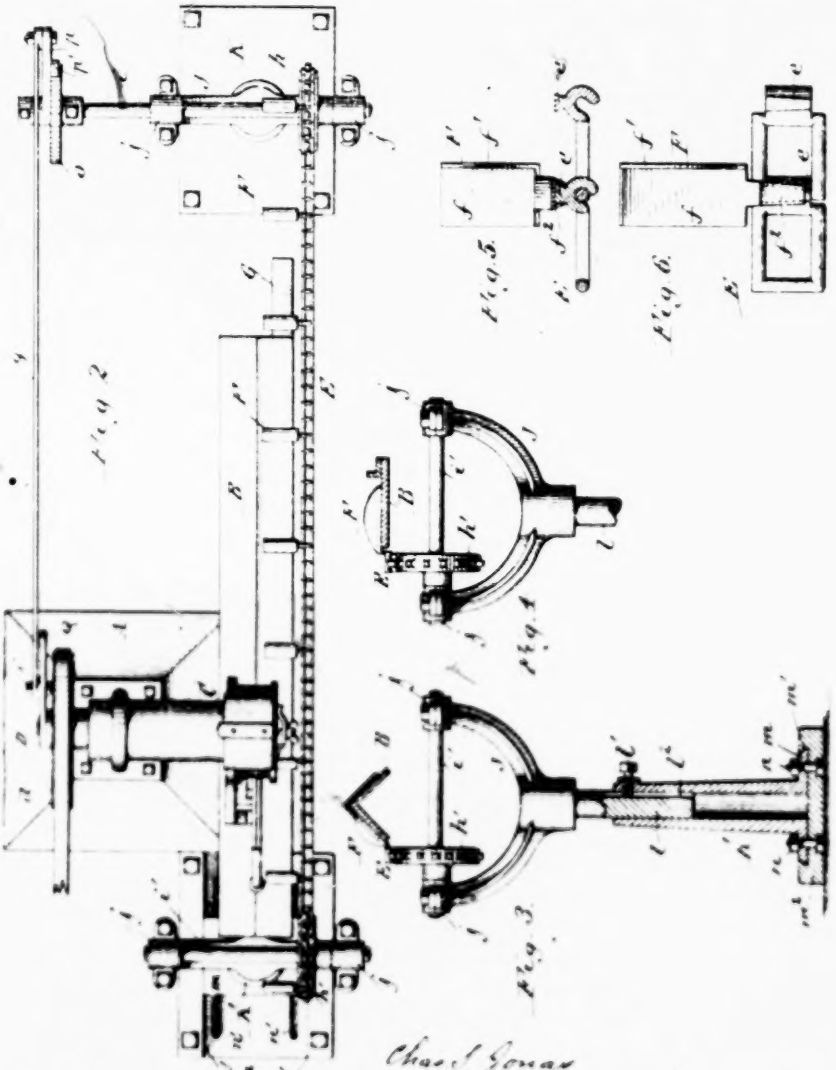
Chas. S. Jonas
Richd. A. Jonas } Inventors.
By Wilkinson Brown
Attorneys.

(No Model.) 2 Sheets—Sheet 2.

C. S. & R. A. JONAS.

WIRE STITCHING MACHINE.

No. 538,021. Patented Apr. 23, 1895.



Witnesses:
Thos. L. Dodge
Chas. F. Burkhardt

Chas. S. Jonas
Rich. A. Jonas } Inventors
By Wilkinson Mason
Attorneys.

This invention relates to that class of wire stapling machines which are usually called wire stitching machines and which are employed for fastening the sheets of pamphlets and other blanks together by wire staples or stitches.

Heretofore the paper blanks were fed to the stitching machine by hand but this requires considerable care and attention on the part of the operator in order to produce approximately uniform work.

The object of our invention is to provide the machine with an automatic feed mechanism whereby the blanks are presented to the stitching mechanism and whereby uniformity in the work and greater speed are insured.

In the accompanying drawings, consisting of two sheets, Figure 1 is a front elevation of a wire stitching machine having a saddle table and provided with our feed mechanism. Fig. 2 is a top plan view of the same. Fig. 3 is a vertical transverse section in line *x*—*x*, Fig. 1. Fig. 4 is a fragmentary sectional elevation similar to Fig. 3 showing our feed mechanism applied to a wire stitching machine having a flat table. Fig. 5 is a fragmentary sectional elevation of the feed chain and one of its wings. Fig. 6 is a top plan view of the same.

Like letters of reference refer to like parts in the several figures.

A represents the main frame of a wire stitching machine; B, the stitching table arranged on the front side of the machine; C, the stitching head arranged over the table; D, the driving shaft journaled in the upper portion of the main frame, and *d* the driving pulley secured to the rear portion of the driving shaft. The stitching table may be either saddle shaped, as represented in Figs. 1, 2, and 3, for stitching folded pamphlet blanks, or flat, as represented in Fig. 4, for stitching flat or unfolded pamphlet blanks. All of these parts may be of any ordinary or suitable construction.

E represents the feed chain or link belt provided with wings or flights F whereby the blanks are carried over the stitching table and presented successively to the stitching mechanism. This chain is arranged with its upper or carrying portion lengthwise in front of the stitching table and consists of chain links, each of which is provided with a dovetail tenon *e* on its outer side, as shown in Figs. 5 and

6. The wings project laterally or rearwardly from the feed chain and consist each of a supporting plate *f* which is adapted to slide over the stitching table and support the blank, a stop or abutment *f'* formed on the rear end of the supporting plate and adapted to engage against the rear edge of the blank and push the blank forward, and a dovetail socket *f²* which engages with one of the tenons on the links and supports the wing.

The operator places the blanks upon the saddle or table between the wings, as the latter pass over the receiving portion of the table, so that the rear ends of the blanks rest upon the supporting plates of the wings. During the forward movement of the feed chain or belt the wings move the blanks forward and present the same successively to the stitching head which latter fastens the sheets of the blanks together by wire stitches. After the blanks have been stitched they are discharged over the delivery end of the stitching table. The feed chain travels with an intermittent movement and the stitching of the blanks is effected while the blanks and carrying mechanism are at rest. The wings can be shifted on the feed chain from one tenon to another to suit the length of the blanks. The tenons of the links and the sockets of the wings are preferably tapered longitudinally, as represented in Fig. 6, so as to cause the wings to be tightly wedged upon the links and firmly held in place.

G represents a curved guide secured to the front or receiving end of the stitching table for the purpose of guiding the wings upon the same.

The receiving and delivering portions of the feed chain pass respectively around driving and delivering sprocket (or belt) wheels *h h'* secured to transverse shafts *i i'*. Each of the latter is journaled in bearings *j* formed upon the upwardly extending arms of a bifurcated support J.

K K' represents hollow standards which receive depending shanks *l l* formed on the supports. These shanks are capable of vertical movement in the standards for the purpose of adjusting the feed chain with reference to the stitching table. The shanks are prevented from turning and also held in their adjusted position in the standards by set screws *l'* arranged in the standards and engaging in longitudinal grooves *l²* formed in the shanks. The stand-

ard K supporting the receiving end of the feed chain is rigidly secured to the floor. The standard K′ supporting the delivery portion of the feed chain is made adjustable lengthwise of the feed chain for tightening the latter by a dove-tail foot *w* which is capable of moving in longitudinal guideways *w′* formed in a base plate *w²*. The standard K′ is held in its adjusted position by means of bolts *u* passing through the foot *w* and longitudinal slots *u′* formed in the base plate.

O represents a ratchet wheel secured to the rear end of the shaft *i* supporting the driving sprocket wheel *h*, and *p* is a rock arm mounted loosely on said shaft adjacent to the ratchet wheel. This rock arm is provided with a pawl *p′* which engages with the teeth of the ratchet wheel.

Q represents a rotating arm secured to the main shaft D of the stitching machine and connected with the outer end of the rock arm *p* by a rod *q* whereby an intermittent rotary motion is imparted to the driving sprocket wheel of the feed chain. The throw of the ratchet mechanism is so adjusted that each revolution of the main driving shaft causes the rock arm to move the feed chain forward a distance equal to the space between two stitches on the blanks. For the purpose of varying the length of the throw of the ratchet mechanism and the length of the space between two stitches, the rotary arm Q is provided with a longitudinal slot *q′* which receives a clamping bolt *r* secured to the connecting rod. This permits the throw of the rock arm and pawl to be adjusted so that the movement of the feed chain corresponds with the size of the blanks and the space between two stitches. The detachable wings of the feed chain are also readily adjusted in accordance with the size of the blanks.

We claim as our invention—

1. The combination with a stitching table and a wire stitching or stapling mechanism, of an intermittently moving feed chain or belt arranged along the stitching table and provided with feeding wings which are adjustable lengthwise of the feed chain or belt, whereby the distance between the wings can be increased or reduced to correspond with the size of the blanks or pamphlets, substantially as set forth.

2. The combination with a stitching table and a wire stitching or stapling mechanism, of a feed chain or belt arranged along the stitching table and provided with feeding wings which are adjustable lengthwise of the feed chain or belt, and a variable intermittent actuating mechanism whereby the feed chain or belt is operated and the travel of the same can be increased or reduced to correspond with the distance between the stitches or staples, substantially as set forth.

3. The combination with a stitching table and a wire stitching or stapling mechanism, of a feed chain or belt provided with laterally projecting feeding wings adapted to pass over said table and each provided with a supporting plate resting on the table and supporting the blank or pamphlet and with an upright abutment arranged along the rear edge of the supporting plate and whereby the blank or pamphlet is pushed along, substantially as set forth.

4. The combination with the stitching table, of a feed chain or belt composed of links each of which is provided with a dove-tail tenon, and wings adapted to pass over the stitching table and provided with dove-tail sockets engaging with said tenons, substantially as set forth.

Witness our hands this 24th day of September, 1892.

Chas. S. Jonas, Richard A. Jonas.

Witnesses: J. H. W. Jonas, John Schenkel.

(Here follow side folios 1235 and 1236.)

[fol. 1237] United States Patent Office

Jason H. Greenstreet, of Indianapolis, Indiana

Shipping-crate

Specification Forming Part of Letters Patent No. 547,486, Dated October 8, 1895

Application filed May 6, 1895. Serial No. 548,279. (No model.)

To all whom it may concern:

Be it known that I, Jason H. Greenstreet, a citizen of the United States, residing at Indianapolis, in the county of

1235-123

(No Model.)

J. H. GREENSTREET

SHIPPING CRATE.

No. 547,486. Patented Oct. 8, 1895.

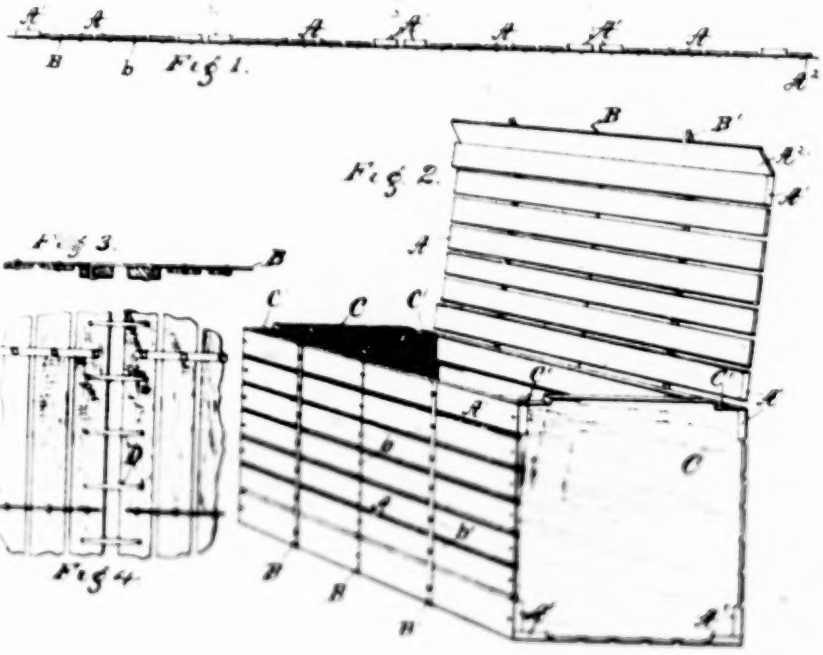


Fig 1.

Fig 2.

Fig 3.

Fig 4.

Witnesses,
[illegible]

Inventor
Jason H. Greenstreet,
By Joseph A. Martin,
Attorney

Marion and State of Indiana, have invented certain new and useful Improvements in Shipping-Crates; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to receptacles for the storage and transportation of articles of merchandise, and is specially adapted for the handling of meats, also of fruits, vegetables, and all manner of commodities requiring a free circulation of air to preserve them in a merchantable condition; and the object of the invention is to provide a crate, box, barrel, or other package, which shall be durable, inexpensive, and simple, and constructed in such manner that the parts can be made up at the factory and shipped in knockdown form to the consumer to be quickly and readily put together by him.

The object also is to provide a construction wherein the contents will be well ventilated, and a construction that will hold its shape under severe test without any bulging out of the sides caused by the weight of the contents or otherwise.

Referring to the accompanying drawings, in which like letters of reference refer to like parts, Figure 1 is an end view of the wood-metal material from which the top, bottom, and sides of my improved crate are constructed, the same being shown in this figure as spread out preparatory to being bent into the box form shown in the dotted lines. Fig. 2 is a perspective view of a complete crate or box, showing the solid wooden ends and that portion of the wood-metal material which forms the lid in a raised position. Fig. 3 is a detail in end view of a modified construction for a large-sized crate, in which the sides, ends, top, and bottom are made in separate pieces and are united to each other at their meeting edges by means of metal clasps or staples; and Fig. 4 is a view in top plan of Fig. 3.

The material of which my improved box, crate, or barrel is made is composed of wooden slats of suitable length, which are joined in parallel series by means of a plurality of metal strands, (wires or flat metal strips,) which are made to pass transversely across the slats and are secured at each intersection by means of staples or by means of tacks or nails. A mixed construction, using part wire and part strips, may be used to advantage, the wire, being cheaper than the strips, effecting a saving in cost, and the

strips being secured by tacks or nails driven through them into the staves, prevent any slipping or movement of the staves longitudinally along the wires. It is not desired, however, to limit this invention to the use of wires or strips, as either may be used alone or both together without departing from the spirit of this invention. It is important, however, that all wires and strips be on the same side of the slats and on that side of the slats which will be outermost when the wood metal material thus produced is formed into the sides, top, and bottom of the box.

In the drawings, A represents the slats, B the wires secured by means of the staples *b*, and B' the strips secured by means of the nails *b'*. In order to produce a stronger and more rigid box, those of the slats which come next to the corners of the completed box will preferably be of extra thickness, as shown at A'. In making up the material before the same is bent into the form of a box the space between the slats A' will be equal to the thickness of the said slats, so as to admit of their being brought into position at right angles to each other in forming the corners.

C represents the ends of the box, and for small and medium sizes will be of wood in one piece or a plurality of pieces fastened together with battens. The corners will be notched, as at C', to accommodate the extra thickness of the corner slats A'. This notched construction, in combination with the heavy corner slats, greatly adds to the strength of the finished box. The top of the box or package will be left unnailed until after the box is filled, and the metal strands will form hinges, whereby the cover will be secured to the box. When the box is properly filled, the cover will be closed and secured by nailing the ends of the slats to the box ends. To securely fasten the front edge, a lap or curtain, consisting of an extra slat A'', will be provided, which [fol. 1238] will be bent down against the front of the box and nailed to the same. The bending down of the curtain will serve to stretch the wood metal material of the top.

In extra large crates or boxes the top, bottom, sides, and ends may all be made in separate pieces from wooden slats connected by metal strands in the manner as described and the several parts united at the corners of the box or crate by means of the metal fasteners D, of usual construction, or in any convenient and secure manner. Where only minimum strength is required, it will not be necessary to make

the corner strips extra thick, and a slat of uniform thickness may be used for the entire construction, and the ends of course will not be notched at the corners. I am aware that packages have been made of a fabric formed of wooden slats woven between strands of wire. The woven nature of the fabric in which the wires are interlaced or woven back and forth from the outer face of one of the slats to the inner face of the next, and so on, makes the fabric elastic in its nature and gives a package constructed from such material the power to stretch equal to the extent of the loose tension and to assume undesirable shapes from the weight of the contents. This interlacing (weaving) is wholly absent in my construction. All of the metal strands are on the same (outside) face of the slats. The strands are drawn taut and are fastened immovably to the slats, enabling me to produce from such a material an iron bound firm package, which will under severe test hold its proper shape and form. By nailing or riveting the slats to the metal band I greatly increase the strength of the packages formed. In the woven construction two small wires, which can be broken separately, are used, while in my construction the same weight of metal, being in a single integral strand, affords greater strength and security. Instead of a single wire strand a cable consisting of two or more wires might be used without departing from the spirit of this invention.

What I claim as my invention is—

A crate or package constructed of wooden slats and metal strands crossing said slats approximately at right angles and secured to the face of the said slats at each intersection, said material comprising the top, bottom, and sides of the box or package, those slats of the said piece which come next to the corners of the box being of greater thickness than the other slats, for the purpose described, and said crate or package having ends in separate pieces secured to the rest of the box and said ends having notched corners to receive the extra thick corner slats, substantially as shown and described.

In testimony whereof I affix my signature in presence of two witnesses.

Jason H. Greenstreet.

Witnesses: Joseph A. Minturn, W. B. Bassett.

(Here follow side folios 1239-1244.)

[fol. 1245] United States Patent Office

Jason H. Greenstreet, of Indianapolis, Indiana

Box-making Machine

Specification Forming Part of Letters Patent No. 579,574, Dated March 30, 1897

Application Filed July 6, 1896. Serial No. 598,184. (No model.)

To all whom it may concern:

Be it known that I, Jason H. Greenstreet, a citizen of the United States, residing at Indianapolis, in the county of Marion and the State of Indiana, have invented certain new and useful Improvements in Box Making Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The object of this invention is to provide a machine for manufacturing the slat and wire material required in the production of the shipping-cases described in Letters Patent No. 547,486, issued to me. The material from which these cases are constructed consists of a series of wooden slats connected by means of transverse wires which are fastened to the slats by staples; and the object of this invention is to provide mechanism whereby the slats and wires can be fed into the machine and the machine will assemble them in proper order, make the staples as they are needed, and drive them so as to fasten the cross-wires to the slats.

I accomplish the objects of this invention by the mechanism illustrated in the accompanying drawings, in which—

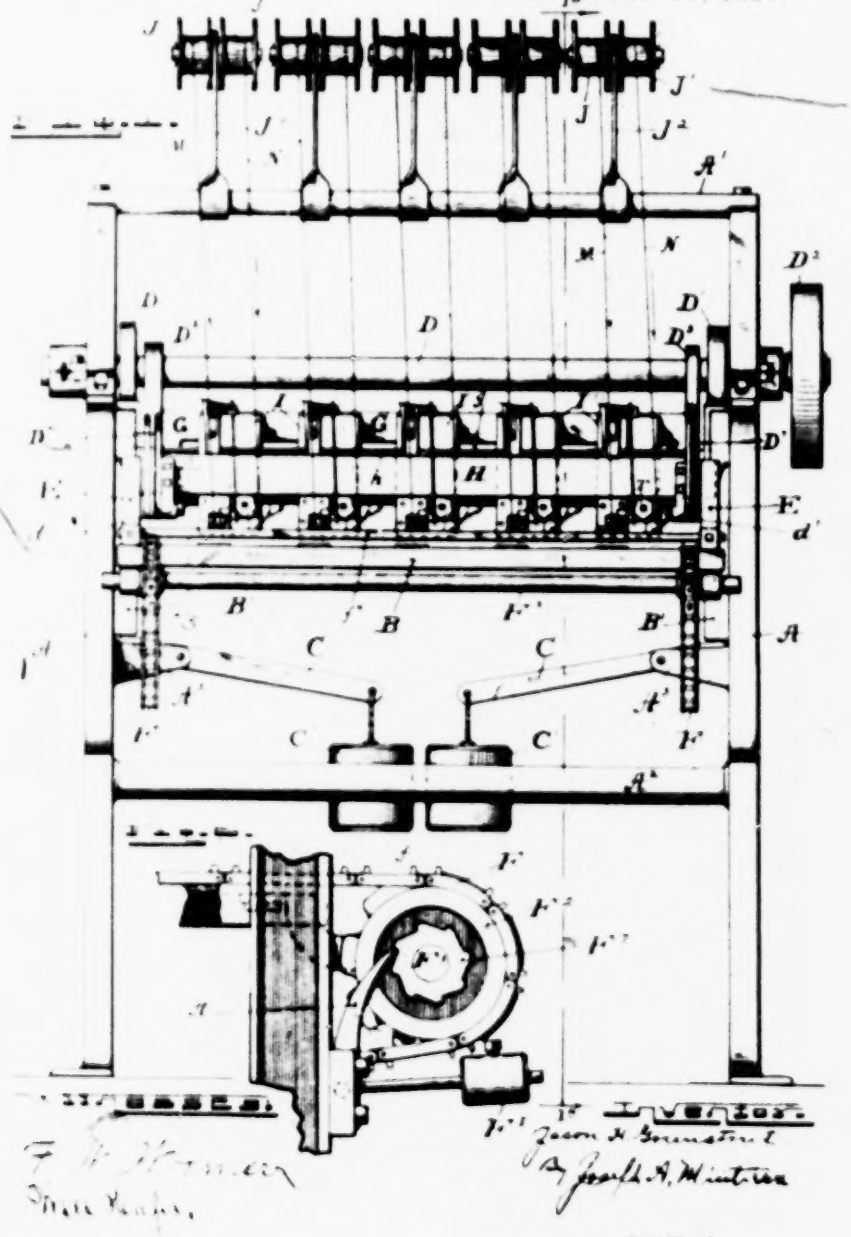
Figure 1 is a view in front elevation of my complete machine; Fig. 1ª, a vertical section on the line 1ª 1ª of Fig. 1; Fig. 2, an enlarged detail of the mechanism for cutting off the wire, forming it into staples, and driving them. Fig. 3 is a side or edge view, partially in section, of the parts shown in Fig. 2, the section being on the line 3 3 of Fig. 2, the view being in the direction of the arrows. Fig. 4 is an under side view of the mechanism shown in Fig. 2. Fig. 5

(No Model.) 3 Sheets—Sheet 1.

J. H. GREENSTREET.

BOX MAKING MACHINE.

No. 579,574. Patented Mar. 30, 1897.



Witnesses:

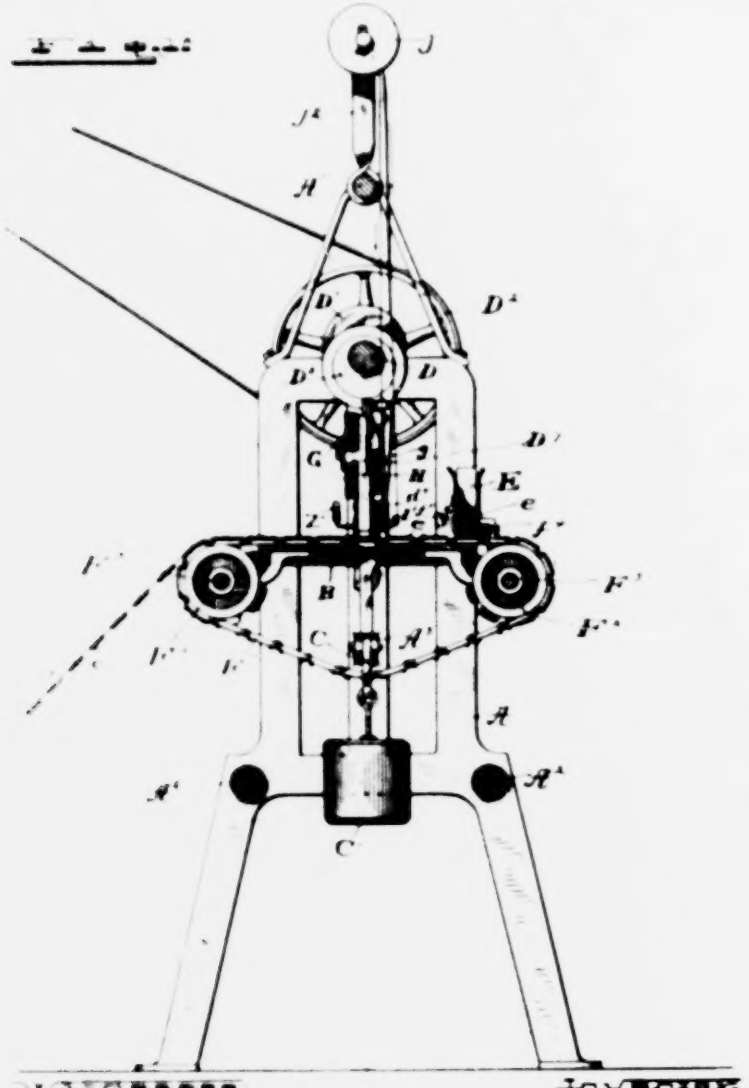
Inventor:
James H. Greenstreet
By Joseph A. Wintsen
Attorney

3 Sheets—Sheet 2

J. H. GREENSTREET.

BOX MAKING MACHINE.

No. 579,574 Patented Mar. 30, 1897.



Witnesses:
W. H. Hoake

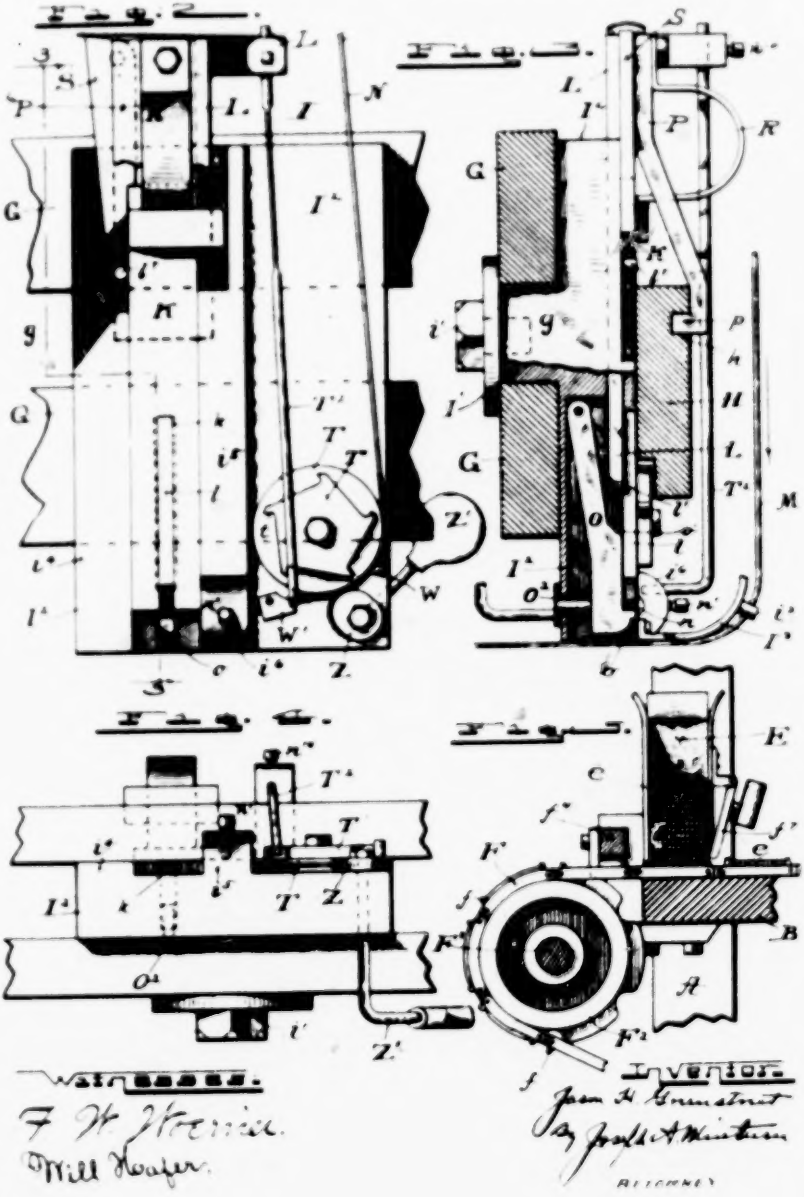
James H. Greenstreet
By Joseph A. Hunter
Attorney

(No Model.) 3 Sheets—Sheet 3

J. H. GREENSTREET.

BOX MAKING MACHINE.

No. 579,574 Patented Mar. 30, 1897.



Witnesses.
F. W. Mowrey.
Will Waters.

Inventor.
John H. Greenstreet
By Foster & Freeman
Attorneys

is a detail on the line 5 5 of Fig. 1, looking in the direction of the arrows. Fig. 6 is a detail of the mechanism for moving the belt for carrying the slats into position under the stapling device.

Similar letters of reference indicate like parts throughout the several views of the drawings.

The frame of my machine consists of the two vertical standards A, which are joined together by means of the upper transverse bar A' and the lower transverse bars A².

B is a horizontal bed plate having the vertical end slides B', which work in suitable ways in the standards A.

A³ are inside brackets integral with the standards A and form the bearings for levers C. The inner ends of the levers C are weighted at C', and the opposite or outer ends of the levers bear against the lower ends of the slides B. The masses C' are of sufficient weight to raise the platform and hold it in raised position until pressed down by the overpowering force of the cams D'. Secured to the top of the bed plate are the three-sided guides E. These are two in number and are placed on opposite sides of the bed plate with their open sides facing inward or toward each other. The slats c are stacked on top of each other flat side up, with their ends resting in the guides.

Passing across the upper face of the bed plate and underneath the slats c are the two link belts F. The belts are on opposite sides of the machine and have spurs or upward projections f, which engage the under slat as the belts move across the bed plate and carry the slat forward. The belts pass over the sprocket wheels F', mounted on shafts F², supported from hangers depending from the under side of the bed plate. On one of the shafts F², as shown in Fig. 6, is a ratchet wheel F³, and as the bed plate to which the shaft is fastened has a vertically reciprocating movement the ratchet wheel F³, being mounted on the shaft, has a reciprocating movement also, and in order to give a rotary movement to the shaft F², such as will carry the chains F forward, I provide a pawl or ratchet A⁴, which is pivotally secured to the frame A of the machine and is forced out into engagement with the ratchet-wheel by means of the weighted arm F⁴. The several parts are so proportioned as to cause the belt to move and carry forward a slat

the bar G by means of a flanged extension F, integral with the body plate F, which fits into the slot *g* in the plate G and is held there by the washer and bolt *f'*. This method of attachment permits of the adjustment of the heads longitudinally of the bar G in a very simple manner, whereby the distance between the transverse wires on the slats can be readily adjusted. M represents these transverse or binding wires for holding the slats together, and N represents the wires from which the staples are made.

I is a bracket secured to the lower end of the plate F. It is curved, as shown, and is provided with an eyelet *i*, through which the wire M is threaded. The wire M is brought down from its spool J, passes through the eyelet *i*, and thence back under the plate F, where it is brought into contact with the slats and secured to them by means of staples, the mechanism for the construction and application of which I will now describe.

f and *i* are parallel extensions from the face of the plate F and form guides for the foot K. The foot K has a reciprocating longitudinal movement between the said guides and is formed with the longitudinal slot *k* in its lower end. Back of the foot K and between said foot and the plate F is what I will designate as the "hammer-bar" L, having a flange *l*, which fits into the slot *k* in the manner as shown in Figs. 2 and 3. The sides of the slot *k* are grooved longitudinally to engage tongues on the sides of the flange. Opposite the flange *l* in the plate F is a slot in which a lever O is pivotally secured in the manner as shown in Fig. 3, and the lower end of the lever is provided with an outwardly extended hook *o*. The hammer-bar L for a suitable distance back of the flange *l* is slotted to admit the lever O, and the top of the slot in the hammer-bar is beveled at *l'* to contact with the beveled outline *o'* of the lever and push the lever O back into its slot when the hammer-bar descends after the two parts have met. The hammer-bar is projected above the top of the foot K and has the bar P bolted to it. This bar P is extended forward and terminates with the hook *p*, which is inserted in the groove *h* in the vertically reciprocating plate H, whereby the hammer-bar is given a vertically reciprocating movement. Also bolted to the upper end of the hammer-bar is a spring R,

which passes through a slot in the bar P and presses down on the upper end of the foot K.

S is a spring pressed log which is pivotally secured to the upper end of the hammer bar and engages the top of the foot bar. It terminates with an inwardly-sloping end which at a predetermined point in the movement of the hammer-bar will contact with the pin *f*, which will throw the dog out of engagement with the foot-bar and allow the hammer-bar, by overcoming the tension of the spring R, to move down without carrying the foot bar with it.

The extension *i* has an enlargement *i*² at its lower end with a transverse opening in which the bushing *u* is held by the set-screw *u'*. The bushing *u* has a central opening through which the wire N to make the staples from is threaded. The wire N is pushed through until its end contacts with the opposite extension *i'*, and the width of the space between the extensions *i'* and *i*² determines the length of the wire to be made into staples. The wire, as shown in Fig. 2, is immediately above the hook *o*. The lever O, of which the hook is a part, is pressed out into position under the wire N by means of the spring-pressed pin O'. The wire for the staple is first cut off by the descending foot K and is bent over the hook *o* into staple form by the continued downward movement of the foot, the staples being drawn up into the grooved slot *k*. At the moment the foot reaches the bottom of the plate I' the dog S strikes the pin *f* and is thrown out of engagement with [fol. 1247] the foot K. The spring R holds the foot down against the slat, which at that juncture is underneath the head I, and the hammer-bar L continues to descend and causes the flange *l* to press the staple into the slat. Countersinks in the bed-plate made in the usual manner will turn the ends of the staples so as to clench them in the wood.

I will now describe the mechanism for feeding the staple-wire N into position to be cut into lengths and formed.

T is a disk with grooved periphery to engage the wire N, which is passed around the disk in the manner shown in Fig. 2. W is a pin to hold the wire close to the disk, and W' is a guide through which the wire after it leaves the disk is threaded. The disk T has an outside ratchet-wheel T with hooked ratchet-teeth *t* to engage the hook T², which is fastened to and works with the hammer-bar L. The upward

stroke of the hammer-bar moves the disk sufficiently to feed the wire in the length of one staple. To keep the wire from working back again, I provide the cam Z, with the weighted lever Z adjusted so the wire can move forward, but will be locked against any return movement. All of the heads I are alike and further description is deemed unnecessary.

The machine, as shown in the drawings and here explained, is for making a shipping-case, the sides of which are constructed from a series of slats; but I am able to bind with wire and secure by staples tight boxes, that is, boxes the sides of which are made from one-piece material or one or more pieces to the side, the only change required being probably a difference in the spurs on the chain and in the absence of the feed-slides. The bed-plate is forced down with a cam and is brought up again by the weighted levers. By this construction the exact height of the bed-plate when it is raised will depend on the thickness of the material used for slats. This self-adjusting construction is a very important feature of my invention. It is quite apparent that springs might be substituted for the weights, and it is not desired to limit this invention to the use of weights.

Having thus fully described my invention, what I claim as new, and wish to secure by Letters Patent of the United States, is—

1. In a box-making machine, the combination with wiring and stapling mechanism, of a bed-plate on which the box material is placed, belts with spurs to engage the material and feed it across the bed-plate, said belts being actuated by the reciprocating movement of the bed-plate, revolving cams for lowering the bed-plate and springs or weights to impart a yielding force to the bed-plate whereby the same will be raised a variable distance according to the requirements as to thickness of the material into which the staples are driven, all substantially as described.

2. In a box-making machine, the combination with wiring and stapling mechanism, of the bed-plate B having vertical reciprocating movement controlled by suitable guides,

weighted levers C' to force the bed plate up against the stapling heads, cams D' to lower the bed plate, link belts F with spurs to engage the slat material, said belt passing over sprocket-wheels in the manner as shown and described, and mechanism for actuating the sprocket-wheels so as to move the feed belt, said mechanism consisting of a ratchet-wheel revolving with the sprocket-wheels and a pawl pivotally secured to the frame of the machine and engaging the ratchet-wheel so as to rotate same as it rises and falls with the bed plate.

3. In a box making machine, a bed plate, revolving cams to force the bed plate down and weighted levers to raise the bed plate and means substantially as specified for feeding the material for the sides of the box across the bed plate, in combination with binding wires and wires to form the staples for fastening the binding wires to the box sides, means substantially as described for delivering the binding wire into proper position and means for making staples out of the wires provided for that purpose, said means consisting of a forming hook over which the wire is fed, a forked bar to cut off the wire and bend it over the hook into a staple, and hold the staple against the strip and from spreading while it is driven and a bar to push the staple into the wooden strip, all substantially as set forth.

4. In a box-making machine, the combination with a reciprocating bed plate to bring the material from which the box sides are made, into contact with the staple-driving mechanism, of a series of staple forming and driving heads and a pair of spools for each head each of which supplies a single wire to one of the heads and said heads each consisting of the following parts: an immovable body-plate I' having a pair of parallel flange-like extensions forming a slideway, and having a groove intermediate of the flange-like extensions, a lever pivoted at its upper end in said groove and having a hook on its lower end, a spring to press the lever so the hook will project beyond the bottom of the slideway, wire fed transversely across the slideway, above the hook, a forked bar working in the slideway to cut off the wire and bend it over the hook into a staple and hold the staple against the box-strip and from spreading

while the staple is driven, a hammer-bar to drive the staple, having a flange to work in the slotted end of the forked bar and having a spring-pressed dog to engage the forked bar and force it down, a pin to throw the dog out and release the forked bar as described, a spring attached to the hammer bar and bearing down on the forked bar, means for imparting a reciprocating movement to the hammer bar, and means for feeding the wire into the slideway to be cut and formed into staples, said means consisting of a grooved disk having a ratchet-wheel actuated from the hammer-bar [fol. 1248] and a weighted clamp to hold the wire from back movement, all substantially as described and for the purposes specified.

5. In a box-making machine, the combination with a reciprocating bed-plate, link belts having spurs, said belts passing over the surface of the bed-plate and moved automatically by said reciprocating bed-plate to bring the material forming the sides of the box into contact with the stapling heads of a stationary plate reaching from one side of the machine to the other and having a central longitudinal slot, staple forming and driving heads of the kind shown and described removably and adjustably secured to said stationary plate, a reciprocating plate parallel with the stationary plate, means substantially as described for transmitting a reciprocating motion to the said plate and means for connecting the plate with the hammer-bar of the staple forming and driving head, all substantially as described and for the purposes specified.

6. In a box-making machine of the kind specified, the standards A having the transverse bars A' and A^2, the platform B having vertical reciprocating movement controlled by ways formed in the frame of the machine, the revoluble shaft D having cams D' to force the bed-plate down, and weighted levers C to raise the bed-plate up, a link belt F having spurs *f*, said belt passing over the bed-plate, shafts F^3 mounted in bearings secured to the bed-plate and having sprocket-wheels over which the link belts are passed, a ratchet-wheel mounted on one of said shafts and a pawl pivoted to the frame of the machine so as to engage the ratchet-wheel and actuate the link belts by the reciprocation of the ratchet-wheel, a stationary plate G having the

longitudinal contral slot *g*, the plate H connected with eccentrics on the shaft D whereby the plate H will be reciprocated by the revolution of said shaft D, the said plate H having the longitudinal groove *h*, the standards J' mounted on the bar A', and the spools J and J' mounted on each of the standards, and wire staple forming and driving heads I constructed substantially as described and removably and adjustably bolted to the slotted plate C and connected with the grooved plate H whereby the proper motion, at any position or adjustment of the heads I will be transmitted to the said heads, all of said parts being combined and arranged substantially in the manner as described and for the purposes specified.

In testimony whereof I affix my signature in presence of two witnesses.

Jason H. Greenstreet

Witnesses: Joseph A. Minturn, F. W. Woerner.

(Here follow side folios 1249 1276)

[fol. 1277] United States Patent Office

Frederick P. Rosback, of Chicago, Illinois, Assignor to William P. Healy, of Same Place

Machine for Making Box-Blanks

Specification Forming Part of Letters Patent No. 608,796, Dated August 9, 1898

Application filed November 27, 1896. Serial No. 613,574. (No model.)

To all whom it may concern:

Be it known that I, Frederick P. Rosback, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Machines for Making Box-Blanks, of which the following is a specification.

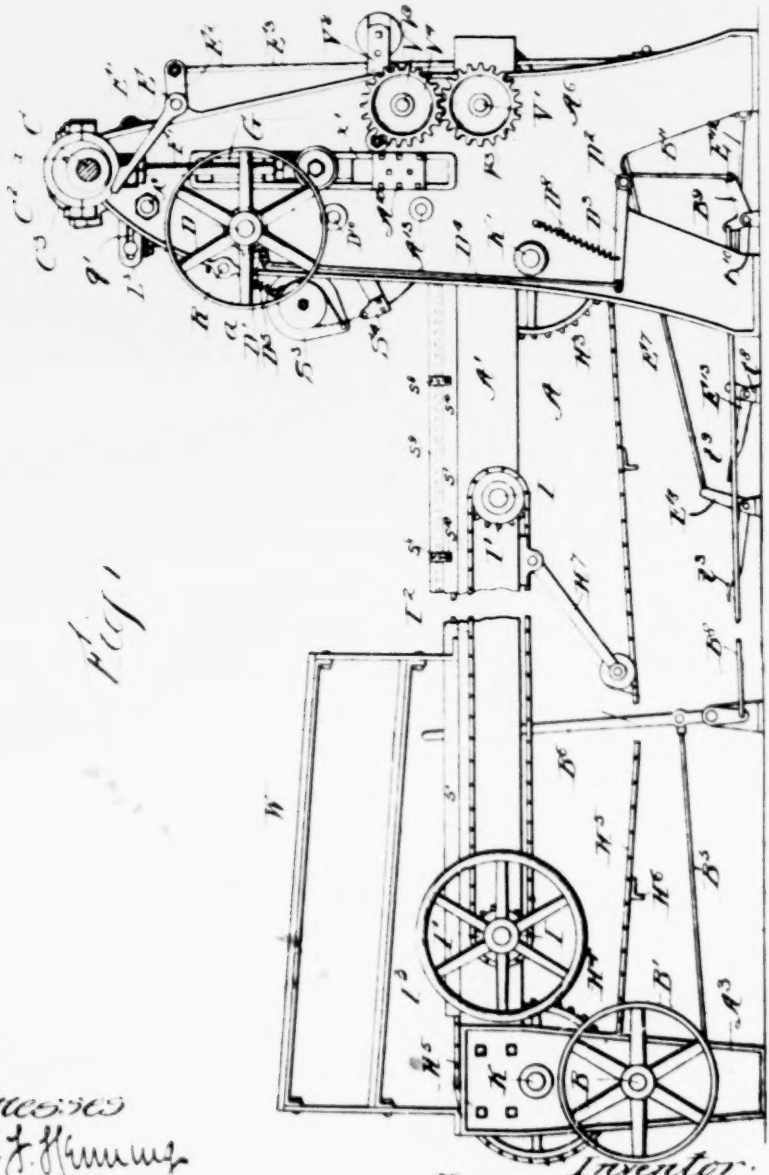
The box-blank which this machine is adapted to manufacture consists of a sheet of thin lumber in one or more

No. 608,796. Patented Aug. 9, 1898.

F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS.

(No Model.) (Application filed Nov. 27, 1896.) 14 Sheets—Sheet 1.



Witnesses:
Wm. J. Hemmes
Wm. M. Rheem

Inventor:
Frederick P. Rosback
By Crosby & Crosby, Atty's.

1251-1252

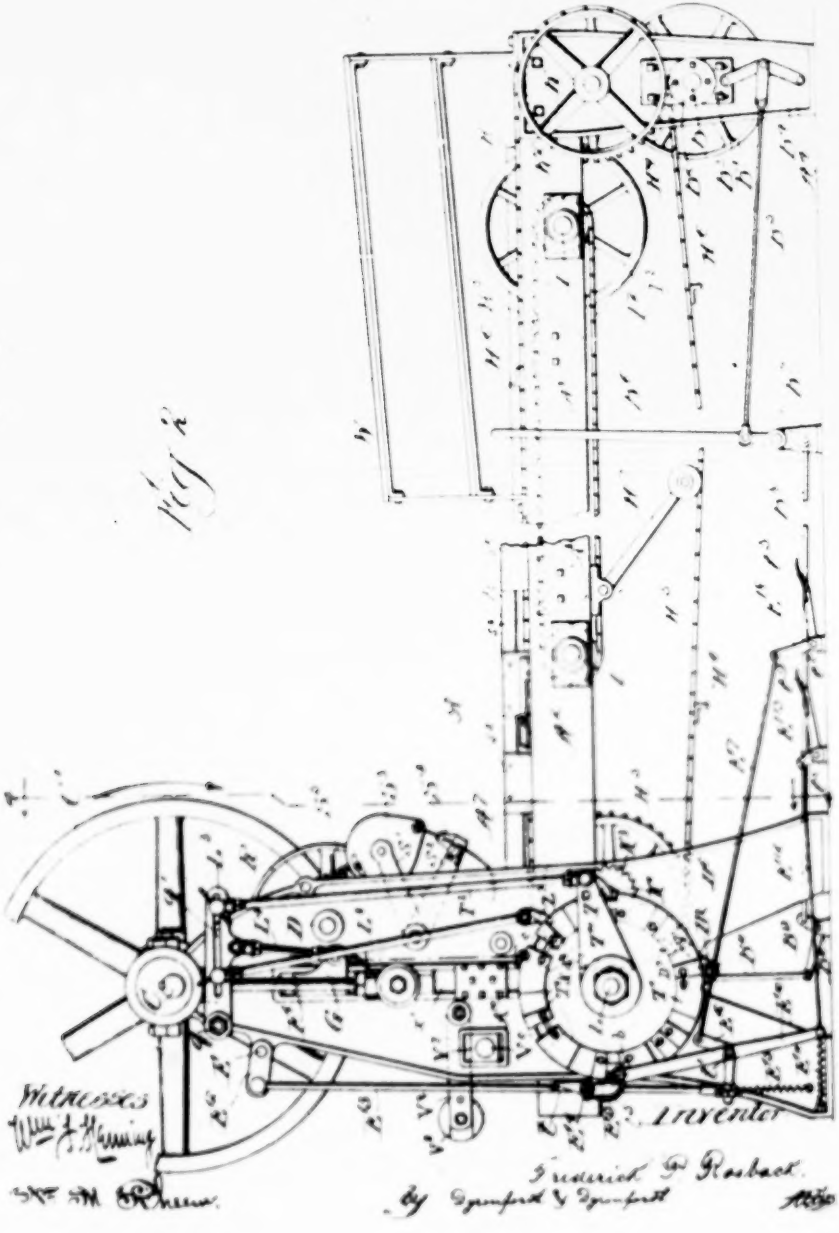
No. 608,796. Patented Aug. 9, 1898.

F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS

(Application filed Nov. 27, 1896.)

(No Model.) 14 Sheets—Sheet 2.



No. 608,796. Patented Aug. 9, 1898.

F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS.

(Application filed Nov. 27, 1896.)

No Model. 14 Sheets—Sheet 3.

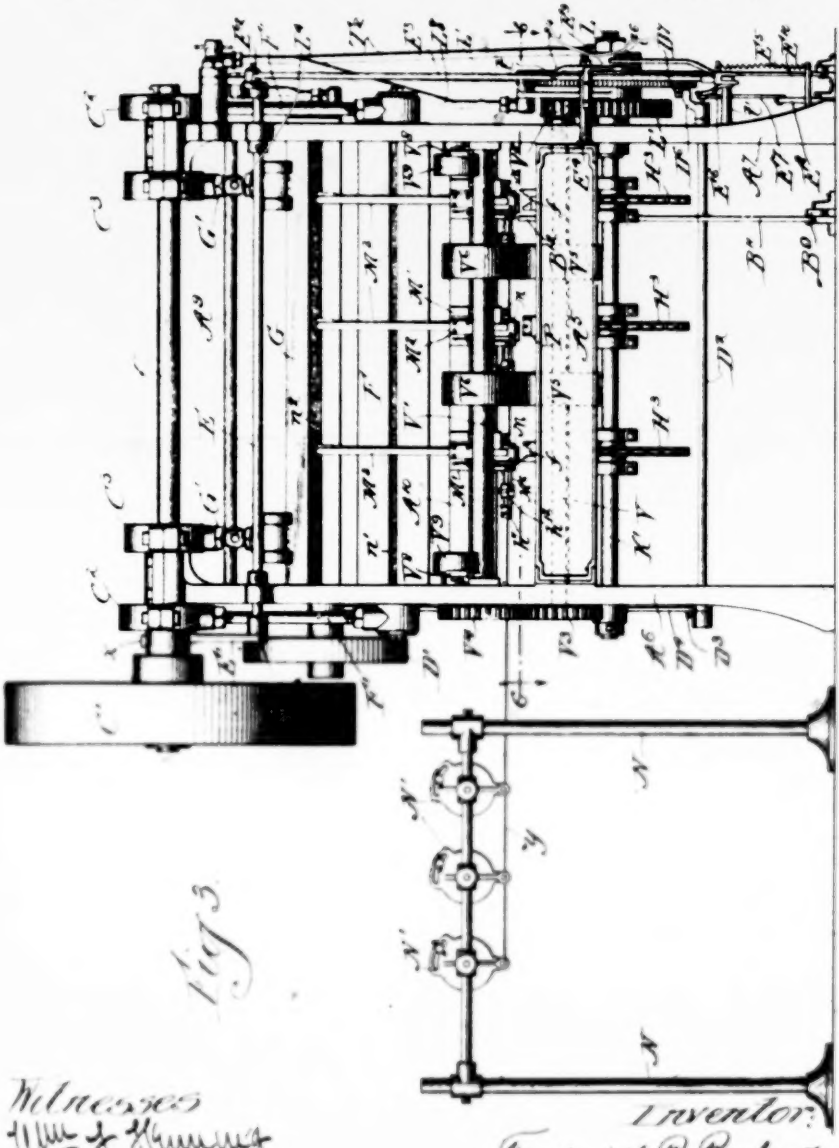


Fig 3

Witnesses
Wm. H. Hammond
Wm. M. Rheem

Inventor:
Frederick P. Rosback,
By Dumford & Dumford
Attys.

1255-1256

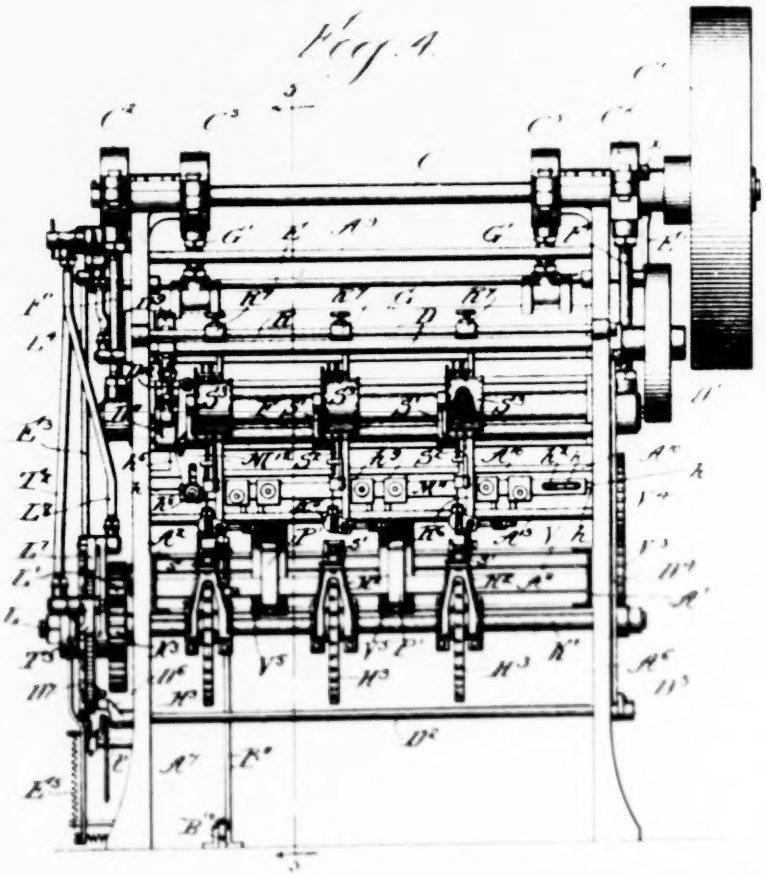
No. 608,796. Patented Aug. 9, 1898.

F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS

(No Model.) (Application filed Nov. 27, 1896.) 14 Sheets—Sheet 4.

Fig. 4.



Witnesses:
Wm. J. Hemming
H. M. Rheem

Inventor:
Frederick P. Rosback.
By Egerton & Egerton.
Atty.

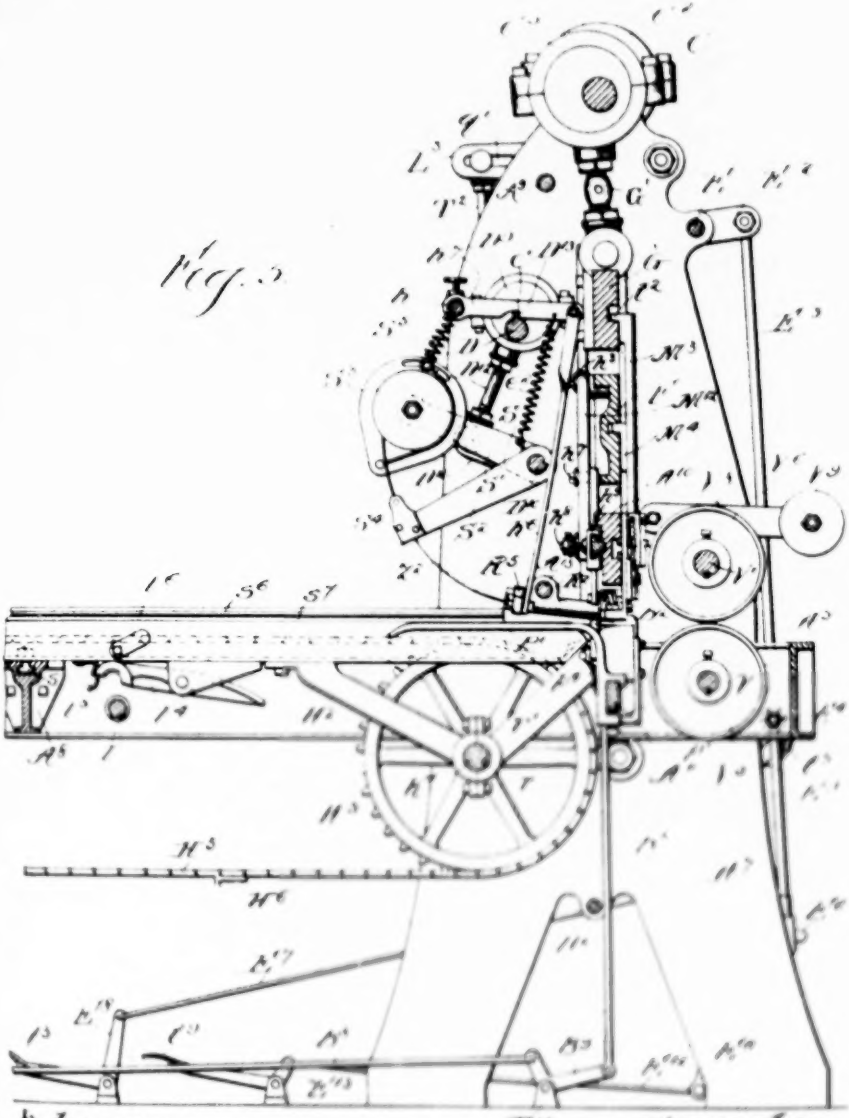
No. 608,796. Patented Aug. 9, 1898.

F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS

Application filed Nov. 27, 1896.

No Model. 14 Sheets—Sheet 5



Witnesses
Wm. A. Hemming
H. Sellers

Inventor:
Frederick P. Rosback,
by Dyrenforth & Dyrenforth
Atty's

1259-1260

No. 608,796

Patented Aug. 9, 1898

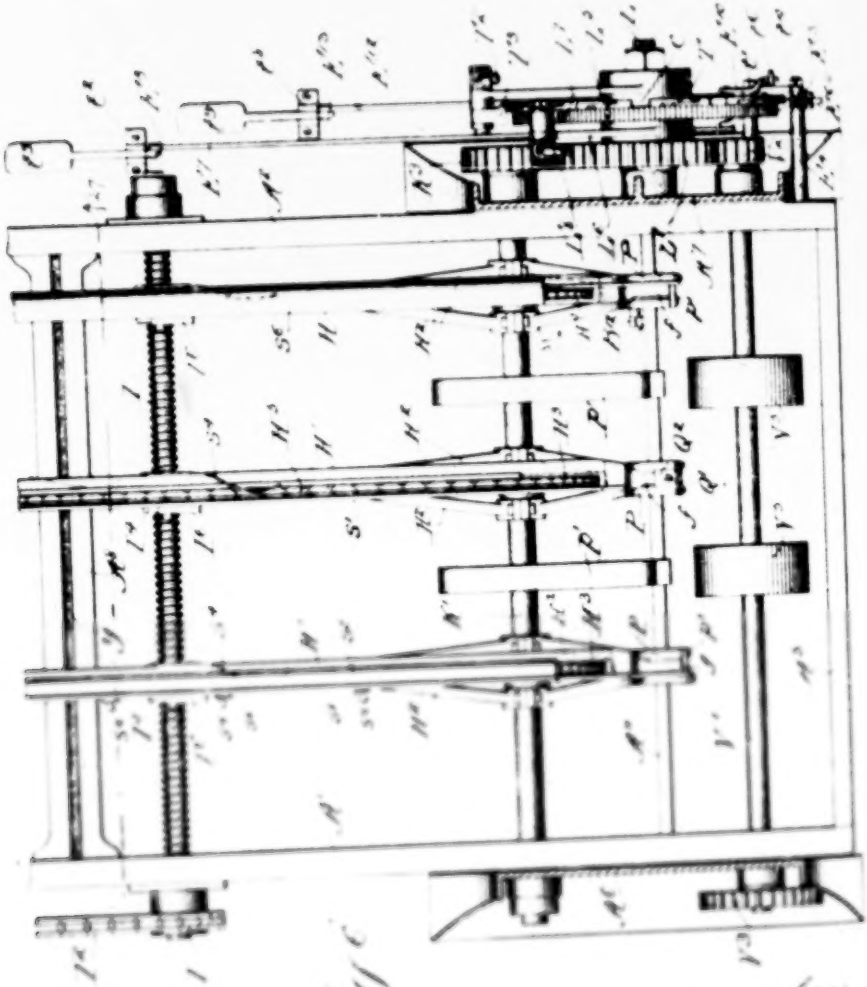
F. P. ROSBACK

MACHINE FOR MAKING BOX BLANKS

Application filed Mar. 27, 1896.

14 Sheets—Sheet 6.

No Model.



Witnesses:

Inventor:

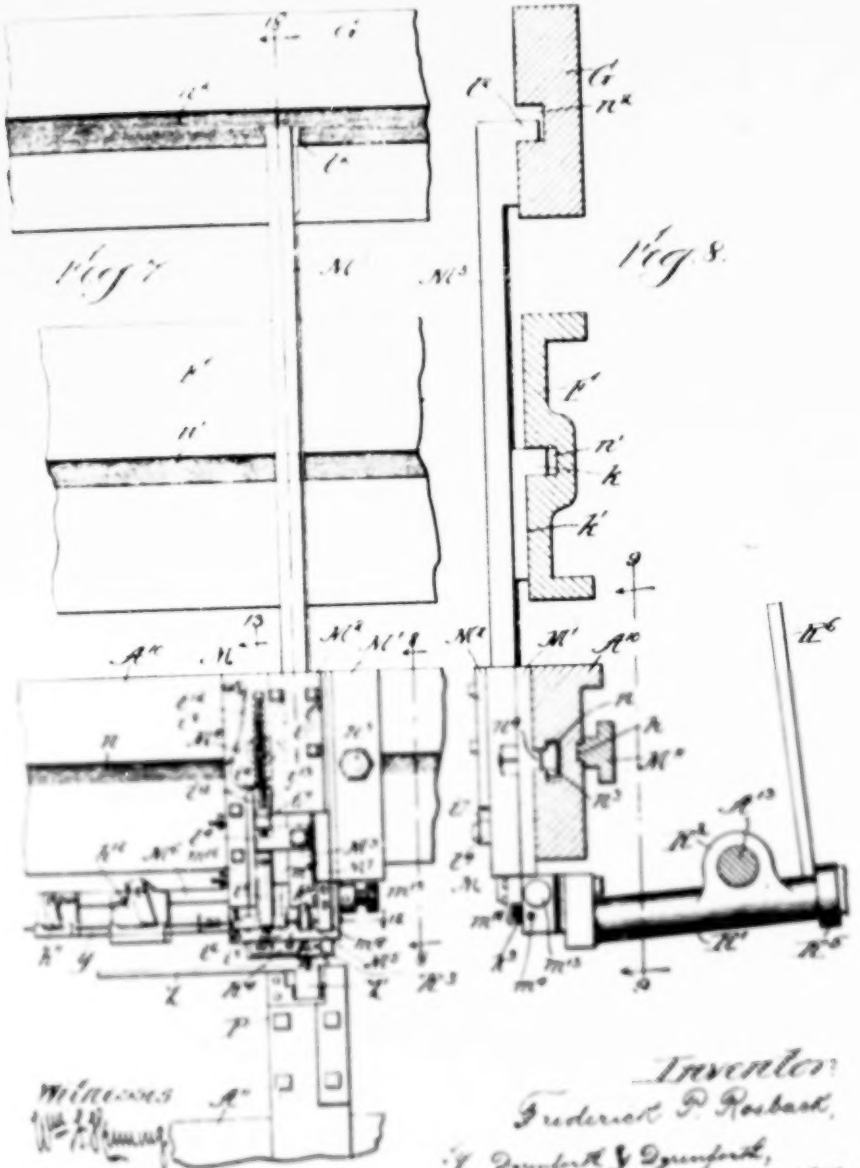
No. 608,796 Patented Aug. 9, 1898.

F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS.

Application filed Nov. 27, 1896.

No Model. 14 Sheets—Sheet 7



Witnesses

Inventor:
Frederick P. Rosback,
by Dumford & Dumford,
Attys

1263-1264

No. 608,796. Patented Aug. 9, 1898

F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS.

(No Model.) (Application filed Nov. 27, 1896.) 14 Sheets—Sheet 8

Fig 9

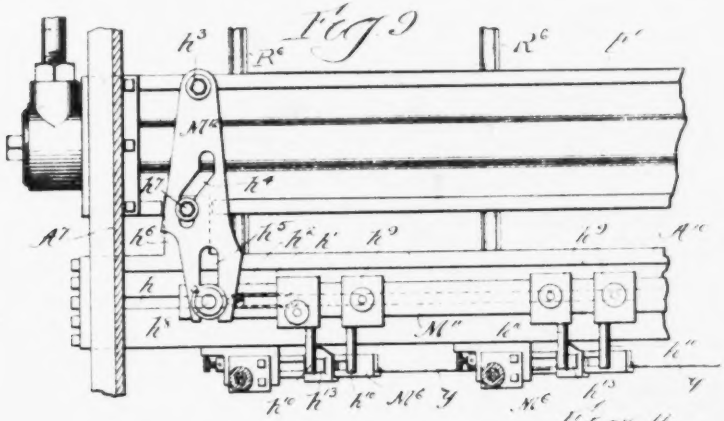


Fig 10

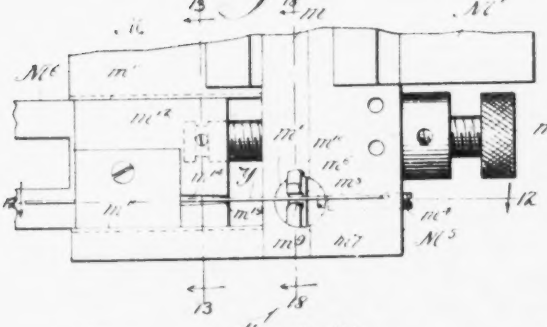


Fig 11

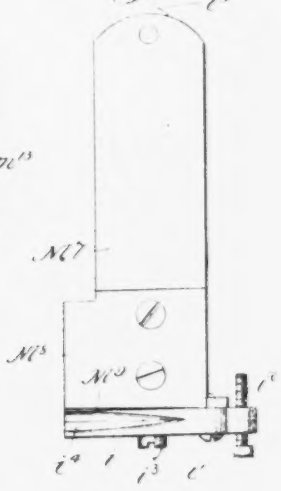
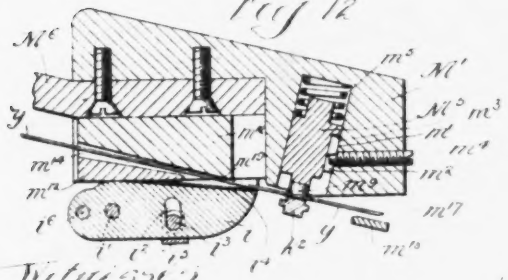


Fig 12



Witnesses:

Inventor:
Frederick P. Rosback
by Dyrenforth & Dyrenforth
Attys

No. 608,796. Patented Aug. 9, 1898.

F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS.

(Application filed Nov. 27, 1896.)

(No Model.) 14 Sheets—Sheet 9.

Fig 13

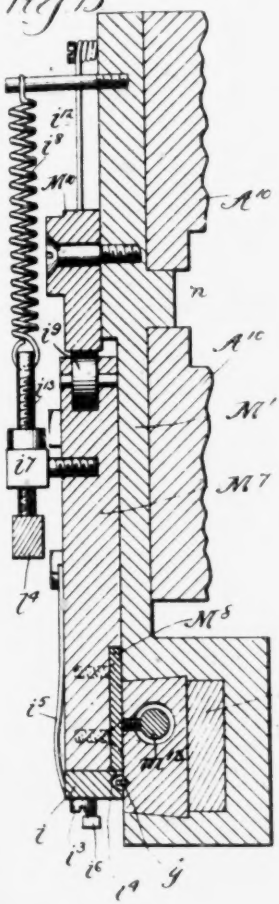


Fig 14

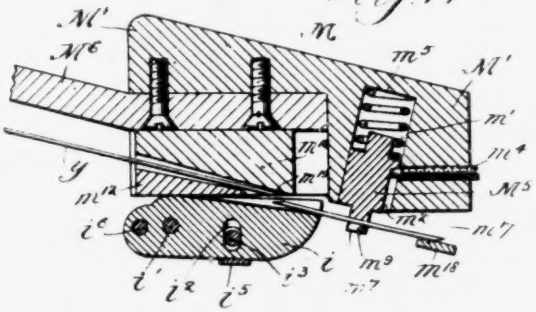


Fig 15.

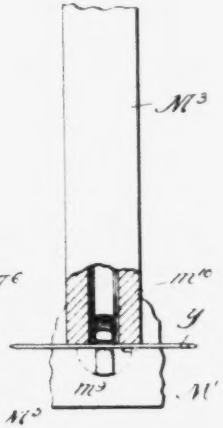


Fig 16.

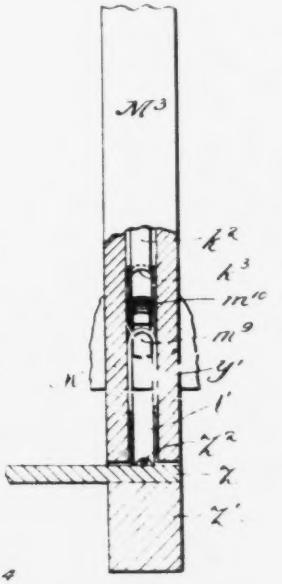
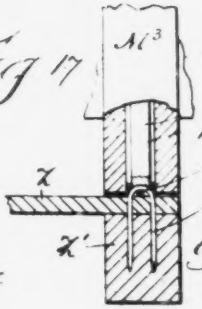


Fig 17



Witnesses
Wm. F. Fleming
Wm. M. Rheem

Inventor
Frederick P. Rosback
by Dyrenforth & Dyrenforth
Attys

1267-1268

No. 608,796. Patented Aug. 9, 1898.

F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS.

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Fig 18.

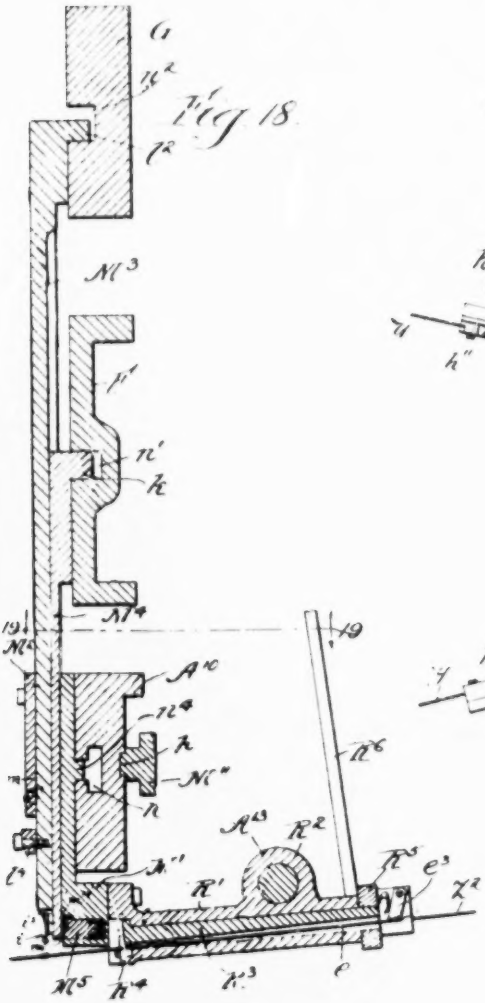


Fig 19.

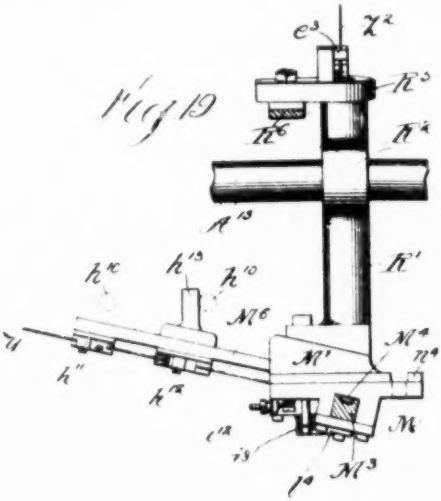
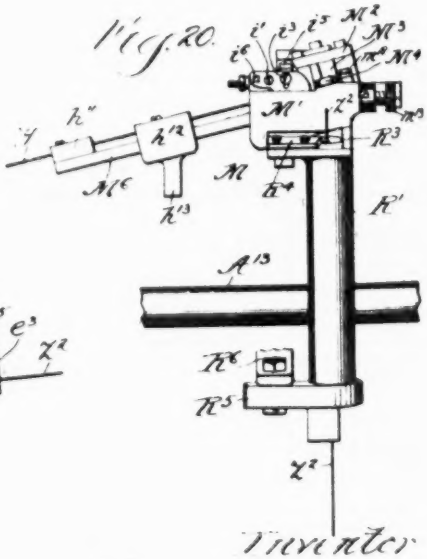


Fig 20.



Witnesses:
Wm. J. Hennig
Wm. M. Rheems

Inventor:
Frederick P. Rosback
By Dyrenforth & Dyrenforth,
Attys.

No. 608,796. Patented Aug. 9, 1898.

F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS.

(No Model.) (Application filed Nov. 27, 1896.) 14 Sheets—Sheet 11.

Fig. 21

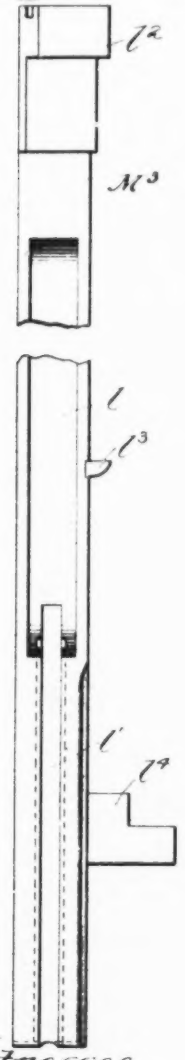


Fig. 22

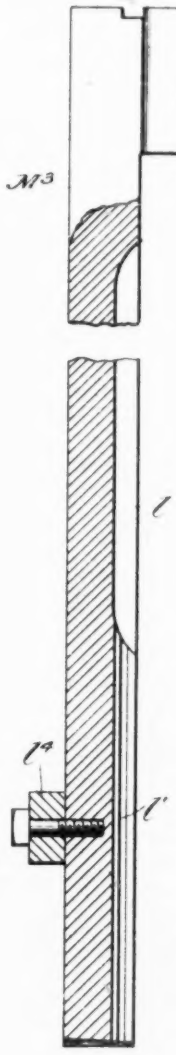


Fig. 23

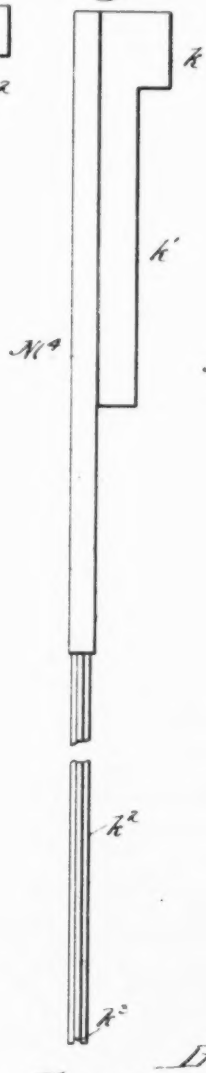
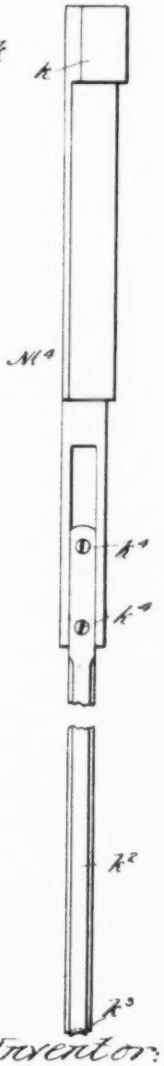


Fig. 24



Witnesses
Wm. F. Hemming
Wm. M. Rheem

Inventor:
Frederick P. Rosback
By Dumford & Dumford,
Attys

1271-1272

No. 608,796. Patented Aug. 9, 1898

F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS

Application filed Nov. 27, 1896.

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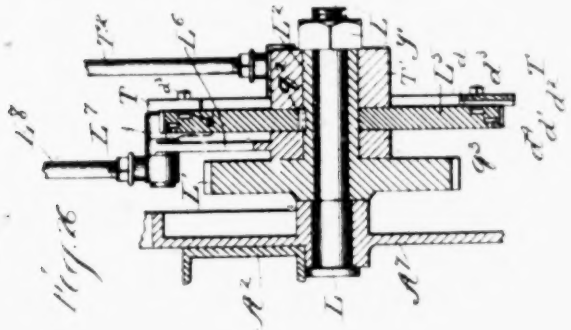
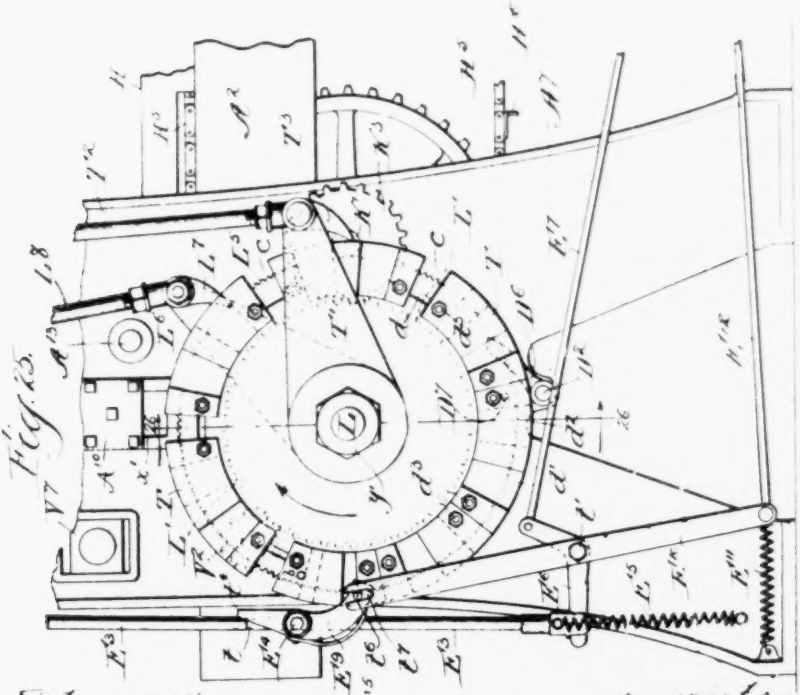




Witnesses
W. L. Hemming
Wm. M. Rheem

Inventor
Frederick P. Rosback
by Dyrenforth & Dyrenforth
Attys.

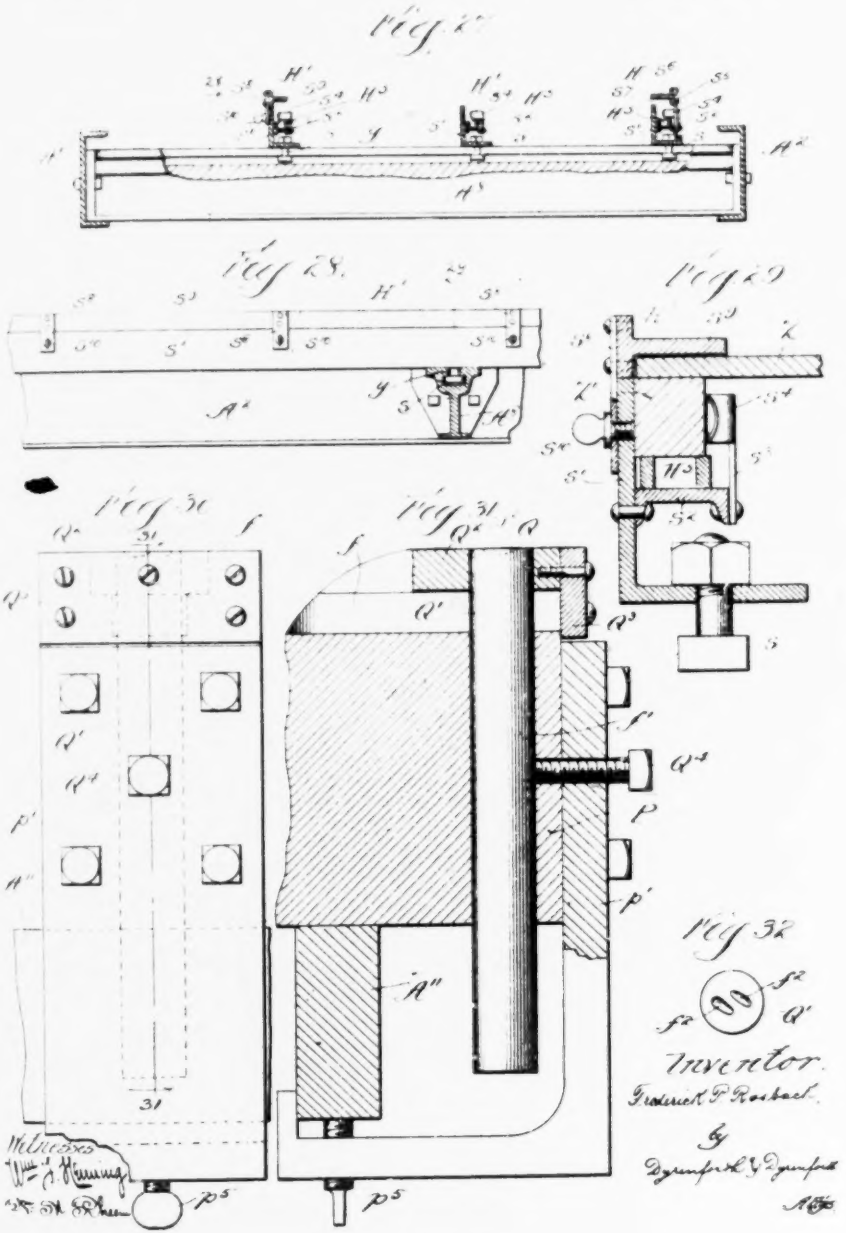
No. 608,796. Patented Aug. 9, 1898.

F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS.

Application filed Nov. 27, 1896.

No Model. 14 Sheets—Sheet 13.



Witnesses
Wm. J. Fleming

Inventor
Frederick P. Rosback
by Dyrenforth & Dyrenforth
Attys

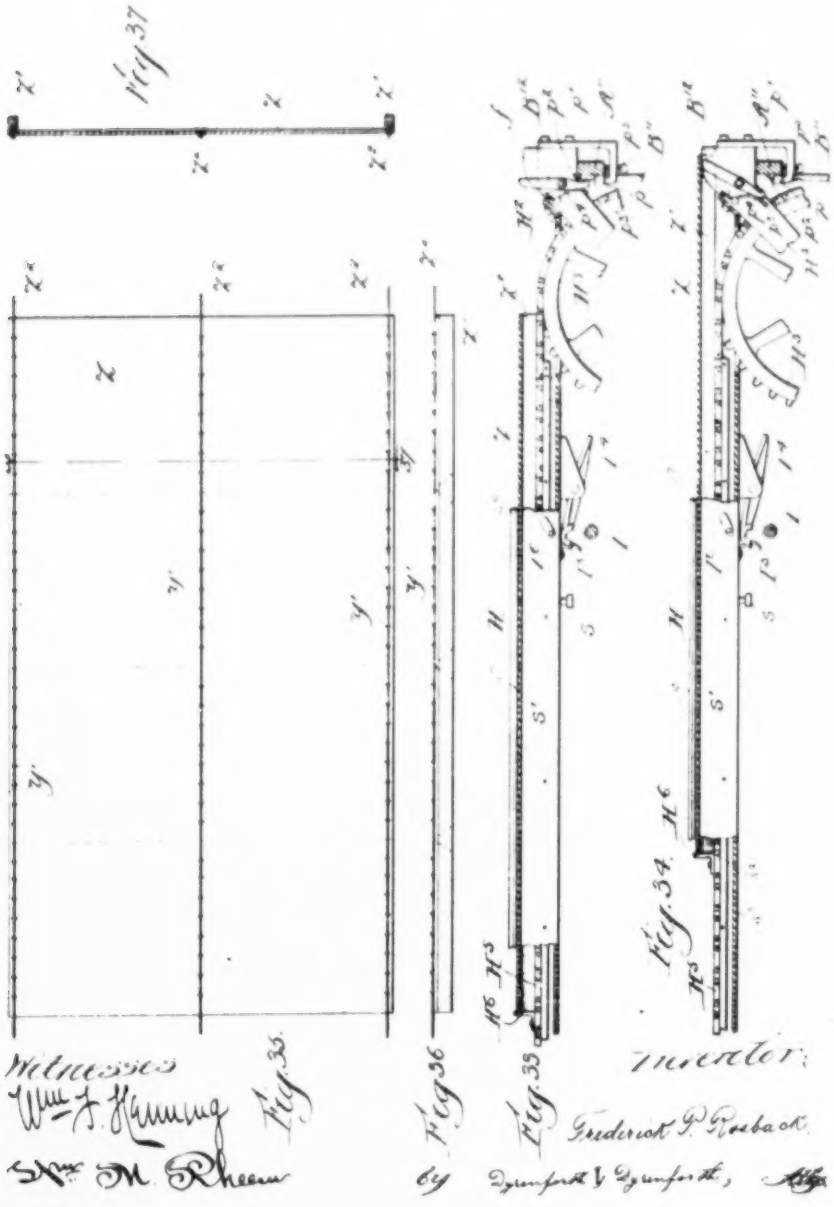
No. 608,796. Patented Aug. 9, 1898.

F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS.

Application filed Nov. 27, 1896.

No Model. 14 Sheets—Sheet 14.



Witnesses
Wm. F. Hamming
Wm. M. Rheem

Fig. 35. Fig. 36. Fig. 33. Fig. 34.

Inventor:
Frederick P. Rosback
by Dumford & Dumford, Atty's

lengths or sections, provided on one side at opposite edges and also between the edges, if desired, with longitudinally-extending reinforcing-cleats and on the opposite side with strengthening-wires, the said wires, sheet, and cleats being fastened together with staples or the like which straddle the wires and extend through the sheet into the cleats. In the case of a comparatively short box the intermediate cleat may be dispensed with and an intermediate strengthening-wire provided and fastened in place by means of staples which are clenched on the inner face of the sheet. A box-blank of the latter description is illustrated in the last figures of the drawings. The strengthening wires extend past opposite ends of the blank, and at the points which are to form corners of a box the cleats and sheet are preferably step-mitered in a machine separate from the present machine. By bending the blank at the cut four sides of a box are produced, and box ends are afterward fastened against the outer cleats with nails or otherwise to complete the box. The cover portion of the box may be fastened down by twisting the projecting ends of the strengthening-wires together.

The present invention is in the nature of an improvement upon machines for the same purpose shown and described in United States Patent No. 518,038, granted to Knudtson and Uhri April 10, 1894, and in an application of Jacob Uhri, Serial No. 569,157, filed November 16, 1895.

My object is to produce a machine of a less complicated and expensive construction than those referred to and which, though operating upon the same general principle, shall perform the work of turning out box-blanks more quickly, perfectly, and economically.

Broadly stated, the machine involves cleat-guides relatively adjustable to position the cleats Z' for blanks of different widths, guides also adjustable with the cleat-guides for the opposite edges of the sheet Z, tacking or stapling devices above the path of the sheet and cleats adjustable with the cleat-guides, and feed mechanism for a strengthening-wire Z^2 at each staple device. At the cleat-guides is preliminary feed-operating mechanism which when the cleats and sheet are placed in their guides may be operated to advance the material to the staple-drivers. The feed mechanism which advances the blank material beneath or across the staple-drivers and strengthening-

wire feeders is intermittent in its action and alternates with the staple-drivers, so that the material is at rest while the staples are being driven.

The machine further involves mechanism for severing the strengthening-wires when a blank has passed from beneath the staple-drivers and for stopping the machine until material for another blank has been advanced to the staple-drivers.

Lastly, the machine involves "skipper mechanism," which at predetermined intervals in the passage of the blank accelerates the feed thereof, so that staples will not be driven at points where the step-miter cuts are afterward to be made.

In the drawings, Figure 1 is a broken elevation of the right-hand side of the machine, the main driving-shaft being in section and the main driving-pulley thus removed; Fig. 2, a broken elevation of the left-hand side of the machine; Fig. 3, a broken elevation of the rear end of the machine; Fig. 4, a section taken on line 4 of Fig. 2 and viewed in the direction of the arrow; Fig. 5, an enlarged broken section taken on line 5 of Fig. 4; Fig. 6, a broken and enlarged plan section taken on line 6 of Fig. 3; Fig. 7, a broken and enlarged elevation of certain details at the rear end portion of the machine, showing a staple forming and driving device and attendant parts; Fig. 8, a section taken on line 8 of Fig. 7; Fig. 9, a reduced section taken on line 9 of Fig. 8, corresponding with line 9 in Fig. 2; Fig. 10, an enlarged broken elevation of the lower end portion of one of the staple forming and driving devices, with cer- [fol. 1278] tain parts removed; Fig. 11, an enlarged detail view of a movable staple-wire cutting and guiding device forming a part of a staple forming and driving device; Fig. 12, a plan section taken on line 12 of Fig. 10, corresponding with line 12 of Fig. 7; Fig. 13, a section taken on line 13 of Fig. 10, corresponding with line 13 in Fig. 7; Fig. 14, a view the same as Fig. 12, but showing moving parts in another position; Figs. 15, 16, and 17, enlarged, broken, and sectional elevations of the lower end portion of a staple forming and driving device, illustrating three steps in its operation of forming a staple and driving it over a strengthening-wire through a sheet and into a cleat; Fig. 18, a reduced section taken on line 18 of Fig. 10, corresponding with line 18 in Fig. 7; Fig. 19, a section taken on

line 19 of Fig. 18; Fig. 20, a broken bottom plan view of the parts shown in Figs. 18 and 19, it being in effect a bottom plan view of any one of the staple forming and driving devices; Fig. 21, a broken elevation of a staple-forming bar, the same being a part of one of the staple forming and driving devices; Fig. 22, a broken view, partly in side elevation and partly in section, of the bar shown in Fig. 21; Figs. 23 and 24, broken elevations of a staple-driving bar which moves in guides on the bar shown in Figs. 21 and 22 to drive the staples after they have been formed; Fig. 25, an enlarged broken elevation showing the intermittent feed and skipper mechanisms, the same parts being shown on a reduced scale in Fig. 2; Fig. 26, a broken section taken on line 26 of Fig. 25; Fig. 27, a section taken on line 27 of Fig. 6, with a portion of the cleat-guide-supporting bar broken away to expose details which would otherwise be hidden; Fig. 28, a section on line 28 of Fig. 27; Fig. 29, an enlarged section of the left-hand cleat-guide bar shown in Fig. 6, the section being upon line 29 in Fig. 28 and enlarged, a sheet and cleat being in position; Fig. 30, a broken elevation of one of the anvils beneath a staple forming and driving device; Fig. 31, a broken section on line 31 of Fig. 30; Fig. 32, a top end or plan view of a clencher-bar shown in Fig. 31; Figs. 33 and 34, broken and reduced sections taken on line 33 of Fig. 6 and illustrating certain details of construction of the feed mechanism and cleat-guides; Figs. 35 and 36, a plan view and a side elevation, respectively, of a completed blank, showing by dotted lines the step-miter cuts; and Fig. 37, a section taken on line 37 of Fig. 35. In each instance the section is taken in the direction of the arrow at the section-line in the figure referred to.

A is the main frame of the machine, comprising for the most part two parallel horizontally-extending side bars A' A^2, mounted at their forward ends upon legs A^3 A^4, an end bar A^5, extending between the side bars at the rear end of the machine; cheeks or side frames A^6 A^7, secured against and supporting the rear end portions of the side bars; cross-bars A^8 in the positions indicated in Fig. 2; a tie-rod A^9 toward the top of the cheeks; a cross-bar A^{10}, fastened at opposite ends to the cheeks, and a cross-bar A^{11} below and parallel with the bar A^{10}.

Passing through and journaled toward opposite end portions in the legs A^3 A^4 is a drive-shaft B, provided beyond the leg A^3 with a belt-pulley B′ and beyond the leg A^4 with a friction drum or pulley B^2. C is what may be termed the "main" drive-shaft of the machine, journaled toward opposite ends in the tops of the cheeks A^6 A^7, and D is a third independent drive-shaft, also journaled toward opposite ends in the cheeks.

Loosely mounted upon the shaft C is a large belt-pulley C″, provided at the shaft with a clutch member, the shaft being provided with a companion clutch member, which when thrown into engagement with the clutch member on the pulley causes the shaft to be rotated by the pulley. The pulley C″ is belted to a suitable line-shaft or other driving power and rotates constantly. Any suitable clutch may be employed in this connection, and as the one I use is of a common construction I have not encumbered the drawings with detail views thereof. It will suffice to say that on one of the clutch members is a spring push-pin *x*, which when pressed in the inward direction against the resistance of its spring releases the clutch members, so that the pulley rotates upon the shaft, and which when released springs outward and produces engagement between the clutch members, whereby the shaft rotates with the pulley.

The clutch-operating mechanism comprises a rock-shaft E, journaled at opposite ends in the cheeks and carrying beyond the cheek A^6 an armor lever E′, which is raised at its free end by the rocking of the shaft E in one direction to extend in the path of the pin *x* and compress the same to release the clutch members and which is swung downward by the rocking of the shaft in the opposite direction to release the pin *x* and permit the clutch members to engage. On the opposite end of the rock-shaft E beyond the cheek A^7 is an arm or crank E^2, to which a vertical rod E^3 is pivotally connected at its upper end.

Rigidly secured to and extending from the rear end portion of the side bar A^2 is an arm or pin E^4, (most plainly shown in Figs. 3 and 6,) provided toward its free end with a guide-opening, through which the rod E^3 passes. Connected with the lower end of the rod E^3 is a spring E^5, which at its opposite end is fastened to a pin extending from the cheek A^7, as shown, for example, in Figs. 2, 3, 4, and 25, the spring operating normally to draw the rod in

the downward direction and press the arm E′ into the path of the pin *x*. Above the guide E⁴ the rod E³ is provided with a notch *t*, (see Figs. 2, 3, and 25,) and at its lower end the rod is pivotally connected to an arm of a bell-crank lever E⁶, the lever being fulcrumed upon a pin *t′*, extend- [fol. 1279] ing from the cheek A⁷. The other arm of the bell-crank lever E⁶ is pivotally connected with a rod E⁷, which at its opposite end connects with an arm of a bell-crank lever E⁸, fulcrumed upon a bracket *t²*, fastened to the floor. The other arm of the bell-crank lever E⁸ is shaped to form a treadle *t³*.

Fulcrumed upon the end of the pin or guide E⁴ is a lever E⁹, provided at its upper end with a laterally-inclined notch-engaging point *t⁴*, (see, for example, Figs. 3, 6, and 25,) a finger-spring *t⁵*, fastened to the guide E⁴, operating to press the lever E⁹ at its end *t⁴* normally into the path of the notch *t* on the rod E³. On the lower end portion of the lever E⁹ is a laterally projecting pin *t⁶*.

E¹⁰ is a lever fulcrumed between its ends upon the pin *t′* and provided at its upper end with a slot *t⁷*, (see Fig. 25,) at which it engages the pin *t⁶*. A coiled spring E¹¹ connects at one end with the lever E¹⁰ and is fastened at its opposite end against the cheek A⁷. The tendency of the spring E¹¹ is to draw the lever E¹⁰ at its lower end in the backward direction. Pivotally connected with the lower end of the lever E¹⁰ is a forwardly-extending rod E¹², which at its opposite end connects with one arm of a bell-crank lever E¹³, fulcrumed upon a bracket *t⁸* on the floor. The other arm of the bell-crank lever E¹³ is shaped to afford a treadle *t⁹*.

It will be understood from the foregoing description that downward pressure upon the treadle *t³* causes the rod E³ to be thrust upward against the resistance of the spring E⁵ and rock the shaft E to swing the arm E′ downward out of the path of the pin *x*, thereby releasing the latter and causing the clutch members to engage and the pulley C′ to rotate the shaft C. When the rod E³ is raised, as described, its notch is engaged by the pointed end *t⁴* of the lever E⁹, and thus held in its raised position to maintain the arm E′ out of the path of the pin *x*. When at any time it is desired to stop the rotation of the shaft C, the treadle

t^9 is pressed downward, causing the lever E^{10} to be swung against the resistance of the spring E^{11} and to swing the lever E^9 against the resistance of the spring t^5 and release it from the notch t, whereby the rod E^3 is released and drawn downward by its spring E^5 to raise the arm E′ into the path of the pin x. Thus when in the rotation of the shaft C the pin x strikes the arm E′ it is depressed and disengages the clutch members. The clutch, it will be noted, always causes a stoppage of the shaft C at the same point in its rotation, the object of which will appear later on.

In the cheeks A^6 A^7 are coincident vertical guide-openings x'. (See Figs. 1 and 2.) On the shaft C just beyond the cheeks A^6 A^7 are companion eccentrics C^2 C^2. Also upon the shaft just within the cheeks are companion eccentrics C^3 C^3.

F is a vertically-movable operating-bar or cross-head extending at opposite ends through and sliding in the guide-slots x', beyond which they are connected, by means of connecting-roads F″ F″, with the eccentrics C^2.

G is a vertically-movable operating-bar or cross-head, also sliding at opposite ends in the guide-slots x' of the cheeks and connected, by means of connecting-rods G′, with the eccentrics C^3. The eccentrics are so adjusted upon the shaft with relation to each other that the eccentrics C^3 move about one-fourth of a revolution in advance of the eccentrics C^2. The cross-heads F G actuate the staple forming and driving devices, hereinafter described, and the cross-head F actuates the intermittent feed mechanism, as will be explained later on.

Resting upon the cross-bars A^5 near the side bar A^2 (see Fig. 27) is a sheet and cleat guide H, which may be stationary. Also resting upon the cross-bars A^5 and extending parallel with the guide H are one or more cleat-guides H′. Each of the said guides is provided with bolts s, having heads which fit and slide in T-shaped sockets y in the cross-bars. (See Figs. 6, 27, 28, and 29.) The guides H′ are laterally adjustable upon the bars A^5 to accommodate sheets of veneer of different widths for boxes of different sizes and to position the cleats as desired.

Extending parallel with the bars A^3 and journaled at opposite ends in the side bars A' A^2 are similarly constructed worm-shafts I, provided beyond the side bar A' with sprocket-wheels I' geared together by means of a drive-chain I^2. (See Fig. 1.) On the forward worm-shaft is a hand-wheel I^3, by means of which the said shaft may be turned in either direction and through the drive-chain I^2 produce corresponding rotation of the other worm-shaft. Each guide-bar H', and the guide H also, if desired, is provided at each of the worm-shafts with a pivotal lever or dog I^4. (See Figs. 5, 33, and 34.) The figures show the dogs raised out of engagement with the worm-shafts I, they being held in their raised positions by spring-catches I^5. To adjust either of the guide-bars laterally, its dogs I^4 may be pressed downward into engagement with the worm-shafts and held in such engagement by turning down swinging latches I^6, which prevent rise of the dogs, after which the worm-shafts are rotated by means of the hand-wheel I^3 to move the guide-bar laterally and equally throughout its extent. When the adjustment is made, the dogs may be returned to the positions shown.

Each of the guides is formed of a bar s', L-shaped in cross-section, and through which the bolts s pass, as shown. Fastened against the bar s' is a shelf or bearing-strip s^2, provided at intervals with fingers s^3, carrying leaf-springs s^4, which project over the strip s^2 in the direction of the bar s'.

On the guide H and forming, if desired, a permanent part thereof are vertical plates s^5, (see Fig. 27,) carrying [fol. 1280] a horizontal strip s^6, which projects over the bearing-strip s^2 and bar s', leaving an open space s^7 to receive and guide one edge of the sheet Z, as hereinafter described. The guide H operates to position one edge cleat Z' and the adjacent edge of the sheet Z.

Adjustably fastened against the guide H', which is to operate as the guide for the other outer cleat and edge of the sheet, are plates s^5, carrying a horizontal laterally-projecting strip s^6, which extends over the strip s^2 and tends to hold down and guide the edge of the sheet. The plates s^5 may be attached to any one of the guides H' by means of thumb-screws s^{10}, as shown. To place a sheet Z

and cleats Z' in position, the cleats are passed from the front end of the machine into the guides beneath the strips s^5 s^5 and between the spring-fingers s^4 and bars s', and the sheet Z is also passed under the strips s^5 s^5, as indicated.

For convenience in handling the sheets a table or sheet-supporting frame W is provided upon the forward end of the machine, as shown, and the strips s^5 s^5 extend from the rear end of the guides forward to a point somewhat in advance of the said support or table. The plates s^5 s^5 are formed, preferably, of thin springy material, whereby the strips s^5 s^5 will yield slightly under an unevenness at the edges of the sheet to prevent binding of the latter as it passes through.

K is a shaft journaled at opposite ends in the legs A^3 A^4, and K' is a companion shaft thereto, journaled at opposite ends in the cheeks A^6 A^7, the shafts being in the same horizontal plane and in the relative positions shown. Each of said shafts is provided with a longitudinally-extending groove r, as shown at the shaft K' in Fig. 5.

Each of the guides H H' is provided on its rear end at the under side with a pair of brackets H^2, having openings r', at which they loosely surround the shaft K'. Confined between each pair of brackets H^2 is a belt or sprocket wheel H^3, provided with a feather to slide in the groove r and cause the sprocket-wheel to rotate with the shaft. The forward end of each guide H H' is also provided at the under side with a pair of brackets having openings, like the openings r', loosely surrounding the shaft K. Between each pair of the latter brackets is a belt or sprocket wheel H^4, feathered upon the shaft to rotate therewith.

No special detail view is given of the brackets at the forward ends of the guides for the reason that they are mere duplications of the brackets H^2 and operate, like the latter, to loosely embrace the sprocket-wheels and slide the latter laterally upon the shaft as the guides are adjusted to position the cleats Z', as before described. The tops of the sprocket-wheels H^3 H^4 are just beyond opposite ends of the shelves or guide-strips s^2 and in the plane of the latter. It will be understood that there is a sprocket-wheel H^3 at one end of each of the guides H H' and a sprocket-wheel H^4 at the opposite end thereof, the sprocket-wheels being ad-

justable with the guides, so as always to maintain the same position with relation thereto.

Extending over each sprocket-wheel H^3 and its companion sprocket-wheel H^4 is a flexible feed-belt, preferably in the form of a chain H^5, which on the upper side rests and slides upon the guide-strip s^2. Each feed-chain is provided at stated intervals (in the present machine nine feet apart) with stop or cleat and sheet engaging projections H^6, they being on the outer side of the chain to project upward as the chains pass from the sprocket-wheels H^4 to the sprocket-wheels H^3 over the guide-strips s^2.

On the under side of each guide, in the position indicated, for example, in Fig. 2, is a chain-tightener H^7 of common construction. The projections H^6 of the respective chains are exactly parallel with each other, so that they travel abreast.

On the shaft K beyond the leg A^4 is a friction-pulley K^2, adapted to engage with the friction pulley or drum B^2. At the pulley B^2 the shaft B is journaled in a vertically-sliding block or plate B^3, (see Fig. 2,) which has vertically-elongated slots, as shown, and is secured to said slots by means of bolts to the leg. A toggle-lever B^4 is pivoted at its lower end against the leg A^4 and its upper end to the plate or journal-block B^3. Connected with the middle of the toggle-lever is a toggle-operating rod B^5, extending to an operating-lever B^6, fulcrumed near its lower end upon a bracket B^7 on the floor. It will be understood that the pulley B' is belted to a line-shaft and rotates the shaft B constantly. Movement of the lever B^6 to the left in Fig. 2 causes it to draw upon the rod B^5 and straighten the toggle B^4 to raise the block B^3, friction-pulley B^2, and that end of the shaft B, so that the pulley B^2 will engage the pulley K^2 and rotate the shaft K and its sprocket-wheels and move the feed-chains H^5, thereby rotating the sprocket-wheels H^3 and shaft K'. When a sheet Z and cleats Z' are first placed in position, the lever B^6 is moved, as described, to feed the material rapidly and without pause to the point where they are first operated upon by the staple forming and driving devices, and this preliminary feed is independent of the intermittent feeding mechanism before referred to and hereinafter to be described.

On the shaft K′ beyond the cheek A^3 is a gear-wheel K^3. (See Figs. 2, 4, 6, and 25.) Passing through the cheek A^3 and fastened therein is a bearing-pin L, threaded along its outer end portion, as most plainly shown in Fig. 26. Mounted upon the bearing-pin at the outer side of the cheek A^3 is a gear-wheel L′, having a bearing-sleeve L^2, which extends nearly to the outer end of the pin and is held against lateral play by a nut q'. The gear-wheel L′ engages the [fol. 1281] gear K^3. Fulcrumed at q upon the cheek A^3 is a lever L^3, provided with a longitudinally-extending slot q'. A connecting-rod L^4 is pivotally secured at its lower end to the adjacent end of the cross-head G, (see Figs. 2 and 3,) and at its upper end it is pivotally connected with the lever L^3 between the ends of the latter.

Fastened upon the sleeve L^2 with a key q^2 or otherwise is a comparatively large ratchet-wheel L^5, which is thus in rigid relation to the gear-wheel L′. Between the said ratchet-wheel and gear-wheel is a lever L^6, having a bearing-sleeve q^3, (see Fig. 26,) which loosely surrounds the bearing-sleeve L^2, and carrying at its free end a pivotal dog L^7, which rides upon the teeth of the ratchet-wheel L^5.

L^8 is a connecting-rod adjustably and pivotally fastened in its upper end in the slot q' of the lever L^3, near the fulcrum q. At its lower end the rod L^8 is pivotally connected with the free end of the lever L^6. In the vertical reciprocation of the cross-head G the connecting-rod L^4 swings the lever L^3 up and down upon its fulcrum q and reciprocates the rod L^8 to swing the lever L^6. In each downward plunge the dog L^7 engages and turns the ratchet-wheel L^5 and in each upward plunge releases the ratchet-wheel, whereby the latter, the gear-wheel L′, gear-wheel K^3, and shaft K′ are rotated intermittingly to return the sprocket-wheels H′ and give to the feed-chains H′ a corresponding intermittent movement.

As will appear later on, when a blank has been completed and its strengthening-wires cut the machine is stopped by bringing about a disengagement between the clutch members on the drive-shaft C′. When the sheet and cleats have been advanced by the preliminary feed, as before described, to the staple forming and driving devices, it is necessary that the preliminary feed be stopped and that the material be afterward advanced by the intermittent feeding mecha-

nism, which is operated, as described, from the shaft C', which also operates the staple-drivers.

The mechanism for automatically stopping the preliminary feed mechanism will be next described. Pivotally connected with the lower end of the lever B^6, below the fulcrum of the latter, is a rod B^7, which extends in the backward direction and connects with one arm of a bell-crank lever B^8, fulcrumed on a bracket B^{10} on the floor. Extending upward from the other arm of the bell-crank lever is a rod B^{11}, (see more especially Figs. 5, 33, and 34,) moving at its upper end loosely through a guide p on a bracket p', carried by the bracket H^2 of the guide H. The upper end portion of the rod B^{11} is provided with notches p^2. Fulcrumed upon the bracket H^2 of the guide H is a tripping-lever B^{12}, provided at its lower end with a hook p^3. A spring p^4, bearing against the tripping-lever, presses the latter at its hooked end normally into the path of the notches p^2 on the rod B^{11}. At its upper end the tripping-lever is rounded, as shown, to produce a cam which extends normally into the path of a passing sheet Z, whereby when the edge of the sheet strikes the tripping-lever the latter is turned from the position shown in Fig. 33 to that shown in Fig. 34. When the operating-lever B^6 is turned to the left in Fig. 2 to start the preliminary feed, the rod B^8 is drawn to raise the rod B^{11} and cause the tripping-lever B^{12} to engage a notch p^2, thereby holding the rod B^{11} raised and the friction-drum B^2 in engagement with the friction-pulley K^2. As soon as the sheet Z strikes the tripping-lever B^{12} the latter releases the notch p^2 and causes the rod B^{11} to drop to the position shown in Fig. 34 and the friction-drum B^2 to descend out of engagement with the pulley K^2, whereby the preliminary feed mechanism stops, leaving the sheet and cleats in position to be operated upon by the staple-drivers.

In the rear face of the stationary bar A^{10} is a longitudinally-extending T-groove n, and in the rear faces of the cross-heads F G are longitudinally-extending grooves n' n^2, respectively.

M M are tacking devices or staple forming and driving devices, one being provided for each guide H H'. The devices M are all constructed alike, so that the description of one will answer for all. The shell of each staple forming and driving device comprises a block or back plate M' and

a removable cap or covering plate M^2, the said plates forming between them a vertical guide-opening m.

M^1 is a staple-forming bar having a vertical guide-groove l l'. This groove is shown in detail in Figs. 21 and 22. The lower part l of the guide-groove is narrower than the upper part l' thereof and is T-shaped in cross-section, as indicated by the full and dotted lines. On the upper end portion of the bar M^1 is a projection or shoulder l^2, and between the ends of the bar is a cam projection l^3. On the bar in the position shown is a laterally-extending projection l^4. M^4 is a staple-driving bar provided at its upper end with a projecting shoulder k and an enlarged body portion affording a bearing-face k'. The lower end portion k^2 of the driving-bar is T-shaped in cross-section and provided in its lower end with a concave socket k^3. (See Figs. 23 and 24.) Although the bar, as shown, is formed of two pieces fastened together with screws k^4, this construction is not essential, as the parts may be formed integral with each other. The upper or enlarged part of the driving-bar M^4 fits and slides in the guide-groove l of the bar M^1, and the T-shaped portion k^2 of the bar M^4 fits and slides in the T-groove l' of the bar M^1.

In practice the back plate M' of the shell is adjustably fastened against the stationary bar A^{10} by means of a bolt n^3, having a T-head which fits the T-groove n. (See Fig. 8.) Projecting from the back plate M' is a horizontally-extending lug n^4, which also fits into the groove n. The shell [fol. 1282] may be adjusted laterally upon the bar A^{10} and tightened in adjusted position by means of the bolt n^3. The said bolt and lug n^4 operate together to hold the shell rigidly against vertical or lateral play. The forming-bar M^1 along its lower end portion fits and works in the guide-opening m of the shell, the shoulder l^2 at the upper end of said bar extending loosely into the groove n^2 of the cross-head G. The shoulder k on the driver M^4 fits snugly in the groove n' of the cross-head F. The parts are so geared with relation to each other that in the rotation of the drive-shaft C the cross-head G is moved downward until the top of its groove n^2 strikes the shoulder l^2 of the bar M^1, forcing the latter downward to form the staple, as hereinafter described, and then the crosshead F descends to force the driving-bar M^4 downward, whereby its end k^3 will engage and discharge or drive the staple.

In the face of the back plate M', in the positions shown, for example, in Figs. 10 and 12, is a socket m', into which fits a plunger or staple-forming block M^3, provided in its side with a guide-recess m^2, terminating in a shoulder m^3. Passing through the edge portion of the plate m' and extending into the guide-recess m^2 is a screw m^4, affording a stop which limits the outward plunge of the block M^3. Confined in the socket m' and bearing against the block M^3 is a spring m^5, which tends to press the block in the outer direction until its shoulder m^3 strikes the stop m^4. On the outer end of the block are two projections or claws m^6 m^7, separated by a guide passage or groove m^8. The lower projection m^7 is provided with a rounded upper edge m^9, affording a mandrel over which the staple is bent, as presently described, and the upper side of the projection m^6 is inclined or beveled to produce a cam m^{10}. Fastened against the back plate M' is a horizontal guide-frame M^6. Mounted in a recess afforded by guides m^{11} m^{11} on the back plate (see Fig. 10) is a horizontally-adjustable sliding cutter-block m^{12}, which may be moved by means of an adjusting-screw m^{13}, which passes through the back plate above the socket m', as shown. Extending through the block m^{12} in the manner most plainly shown in Fig. 12 is a guide-opening m^{14} for a wire Y, from which the staples Y′ are formed. The opening or passage m^{14} is in line with the guide-opening m^8 between the claws m^6 m^7. Sliding between vertical guide-projections m^{15} m^{16} on the back plate M' (see Fig. 7) is a block or plate M^7, (shown in detail in Fig. 11,) carrying a knife M^8, provided with a cutting edge M^9. A yielding block i is pivotally fastened by means of a screw i' against the under side of the block M^7. Extending through the block i is a vertical and elongated slot i^2, through which passes a screw i^3 into the lower end of the block M^7. The block i is provided in its face with a gradually widening and deepening guide-groove i^4 for the wire Y, (see Figs. 11, 12, 13, and 14,) and a finger-spring i^5 on the block M^7 bears against the block i to press it normally against the face of the block m^{12}. On the end of the block i is an adjustable set-screw i^6 in position to strike against the lower end of the guide m^{16} when the block M^7 is raised. Projecting from the plate or block M^7 is a bolt i^7, having a

threaded opening through it for a tensioning-screw i^{13}, (see Fig. 13,) to which is attached a spring i^{7}, fastened at its upper end to a pin on the back-plate M'. The lower end of the tensioning-screw i^{13} affords a stop for the projection l^{4} on the forming-bar M^{4}. The spring i^{7} tends normally to raise the block M^{5} until the set-screw i^{8} engages the lower end of the guide-piece m^{10}. Journaled in the upper end of the block M^{5} is an antifriction-wheel i^{9}. M^{10} is a pivotal cam-block having a cam-surface i^{10} and a cam projection i^{11}. A spring i^{12} bears against the block M^{10} to press the cam-surface i^{10} against the antifriction-wheel i^{9} and cause the cam projection i^{11} to extend normally into the pat of the cam projection l^{5} on the side of the forming-bar M^{4}. In the forward face of the stationary cross-bar A^{10}, on the side opposite the groove n, is a guide-groove h, sliding in which is a longitudinally-extending bar M^{11}, T-shaped in cross-section, as shown, for example, in Figs. 8 and 18. Toward each end of the bar M^{11} (see Figs. 4 and 9) are elongated slots h', through which pass screws h^{2}, fastened in the bar A^{10}. These screws hold the bar M^{11} against the stationary bar A^{10}, but permit it to slide longitudinally for a distance limited by the ends of the slots. M^{12} is a swinging plate or lever (see example, Fig. 9) pivoted at h^{3} to the cross-head F. Between its ends the lever M^{12} is provided with a cam-slot h^{4}, and in its lower end it has a recess or socket h^{5}. On the stationary bar A^{10} is a vertically-projecting lug h^{6}, carrying a screw or pin h^{7}, which passes through the cam-slot h^{4} in the lever M^{12}. At its recess or socket h^{5} the lever loosely embraces a pin or screw h^{8} on the bar M^{11}. In the rise and fall of the cross-head F the lever M^{12} rises and falls, the engagement of its cam-slot with the pin or screw h^{7} causing it to oscillate on its pivot h^{3} and reciprocate the bar M^{11} longitudinally. Adjustably fastened to the bar M^{11} are blocks or heads h^{9}, in pairs, each provided with a downward-extending pin h^{10}. On each frame M^{6} (see, for example, Fig. 7) is a swinging wire-engaging dog h^{11}, which permits the wire Y to be drawn in the direction to the right in that figure and prevents its being drawn to the left. Mounted to slide in each frame M^{6} is a block h^{12}, carrying a swinging dog or wire-gripper which grips the wire and moves it when the block is moved to the right in Fig. 7 and releases the wire when the block is moved to the left in that figure. On the side of the block h^{12} opposite that at which

it carries the dog is a lug h^{13}. The lug h^{13} projects between a pair of pins h^{16}, the latter being so adjusted that one strikes the lug h^{13} and moves the block h^{12} when the bar M^{11} [fol. 1283] is moved in one direction and the other strikes the lug and moves the block h^{12} when the bar M^{11} is moved in the opposite direction.

Mounted upon a frame N (see Fig. 3) at one side of the machine are supplying-reels N′ for the staple-wires Y. A separate reel N′ and separate staple-wire Y is provided for each staple forming and driving machine. The wire Y from a reel is passed under the dogs h^{13} and the dog on the block h^{12} and through the guide-openings m^{14} in the block m^{12}. In the rise of the cross-head F to the position shown in Fig. 9 the bar M^{11} is pushed to the right in that figure, or to the left in Fig. 7. In the descent of the cross-head F the bar M^{11} is moved to the left in Fig. 9, or to the right in Fig. 7. In the first of said movements a finger or pin h^{15} moves the block h^{12} to the left in Fig. 7, and in the second said movement a finger h^{15} moves the block h^{12} to the right in Fig. 7, causing its dog to engage the wire Y and advance it through the guide slots m^{13}, c^{5}, and m^{5} behind the driving-bar M^{4}, which is then down, as shown. The dog h^{13} grips the wire and holds it against retraction while the block h^{12} is moving to the left in Fig. 7. As the wire Y is advanced through its guides it is directed at its free end into a recess m^{17} in the lower end of a stationary guide piece m^{15}, fastened against the plate M′, as shown, for example, in Figs. 7 and 12. The gearing of the mechanism is so timed that just as the wire Y is advanced to the position shown, for example, in Fig. 12 the forming bar M rises to a point wherein its cam projection l strikes the cam projection i^{21} on the cam-block M^{10} and turns the latter to force the block M^{7} down against the resistance of its spring i^{6}, and also the knife M^{8} and pivotal block i carried thereby. In the descent of the block i its guide groove i^{4} acts as a cam to press the wire closely against the part or cutting edge m^{18}, Figs. 10 and 12, of the block m^{12}, so that in the further descent of the block M^{7} the knife shears the wire in a manner to produce a bevel or pointed end. The cam projection l wipes past the cam-block M^{10}, permitting the spring i^{6} to raise the block M^{7} and its attendant parts. In the upward movement of the cross-head which is taking place at this time the lower end of the

driver rises past the cam-surface n^{10} and permits the block M^{5} to spring outward and force the wire Y where it passes through the guide m^{5} outward into the path of the T-groove l' in the forming-bar M^{4}. While the cross-head F is still moving upward to the limit of its rise, the cross-head G starts downward and engages the top of the bar M^{4} to plunge the latter downward past the position shown, for example, in Fig. 15, to engage and bend the wire Y at its center over the mandrel m^{4}. The prongs of the staple rest in the sockets forming the opposite sides of the T-groove in the forming-bar, as shown, for example, in Fig. 16. Following this action the staple-driver M^{6} descends, engages at its end k^{5} the top of the staple, and forces the latter downward and out of the forming-bar, as shown in Fig. 17. As the staple-driver descends to the staple its lower end engages the cam-surface n^{11} of the mandrel-block or plunger M^{5} and forces the latter inward against the resistance of the spring m^{7} to the position shown in Figs. 12 and 18. Thus before the driver strikes the staple the mandrel is pushed out of the way and releases the staple. While the cross-head F is nearing the limit of its plunge in the downward direction, the cross-head G commences to rise. Owing to the fact that the groove n_2 in the cross-head G is wider than the shoulder l^{5} on the bar M^{4} there is sufficient lost motion between the parts to cause the cross-head to engage and lift the forming-bar only after the staple-driver has been plunged the full limit in the downward direction. Thus the bar M^{4} remains as a guide for the staple until the latter has been driven, as shown in Fig. 17. The yielding block i and the recess m^{12} in the guide-block m^{13} operate to prevent the wire Y from springing outward while it is being formed into a staple Y'. In the event that the block M^{5} should for any reason stick and be prevented from rising under the resilient action of the spring i' the stop-projection z' on the bar M^{4} will engage the lower end of the screw z^{2} and slide the block M^{5} upward to its normal position. The size of the staples Y' may be changed as desired. To form a longer staple, for example, the blocks h^{2} are adjusted upon the bar M^{13} so that pin h^{3} will have a longer engagement with the respective lug h^{4}, and thus move the block h^{12} farther and feed more wire, and the adjusting-screw m^{14} is turned to move the cutter-block m^{15} farther away from the mandrel m^{6}. The adjustment by

means of the screw m^4 should always be such that the mandrel m^5 will be midway of the length of the wire which is severed. To produce a shorter staple, the blocks h^9 are adjusted to effect a shorter engagement of the pins h^{10} with the lug h^{11} in each operation and feed less wire, and the cutter-block m^2 is moved, by means of the adjusting-screw m^4, correspondingly nearer to the mandrel.

The intermittent feed mechanism for the sheet and cleats is so geared with relation to the staple-drivers that in the descent of the cross-head G, during which time a staple is formed, as described, the lever L^7 is swung downward to cause the pawl L^8 to turn the ratchet-wheel L' and attendant gears and feed-chains to advance the sheet and cleats the desired distance. This distance may be varied by changing the adjustment of the connecting-rod L^9 in the slot q' of the lever L^7. The staples are driven during the initial rise of the cross-head G, the driving operation being completed when the said cross-head engages and commences to raise the forming-bars M. With the initial rise of the cross-head G the pawl L^8 releases the ratchet-wheel L' to stop the feed. Thus the intermittent feed alternates in its action [Col. 1284] with the staple-drivers and causes the sheet Z and cleats Z' to remain stationary while staples are being driven.

Forming a part of each pair of brackets H^2 where the latter rests upon the stationary bar A^{11} is an anvil-block P. The block is steadied in position by the bracket p', which extends under the bar A^{11} and carries a set-screw p^2, which is tightened against the said bar, as shown. Fastened upon the bar A^{11} between the anvils are forward-projecting brackets P'' (see Figs. and 6) for the under side of the sheet Z. In the top of each anvil P is a groove t (see Figs. 30 and 31) in the plane of the adjacent cleat-guide and through which the cleat slides. The anvils take the impact when staples are driven.

When it is desired to form a blank like that shown in Figs. 35 and 36, without an intermediate cleat, the intermediate strengthening-wire must be stapled to the sheet and clenched on the under side of the latter. For this purpose I provide a vertical opening t' through each anvil and a clencher Q at the staple-driver where no cleat is to be fed, consisting of a bar Q', provided on its upper end with a collard Q^2 and

downwardly-projecting bearing-plate Q. The bar Q' fits the opening *t'* and the collar Q² and plate Q rest upon parts of the anvil to steady and position the clencher. The parts may be fastened in place by means of a set-screw Q³, as shown in Fig. 31. In the upper end of the bar Q' are upsetting-sockets *t*, as shown in Figs. 31 and 32, which receive the points of the staples as they are driven and upset and clench them, as shown in Fig. 37.

The strengthening-wires Z in the formation of each blank are initially fed beneath the staple forming and driving bars centrally of the latter to extend beyond the end of the sheet and cleats and be in a position to be straddled by the staples as they are driven. When the first staples have been driven, the strengthening-wires will be drawn along with the material intermittingly, and therefore only initial feeding mechanism for the strengthening-wire is provided. This mechanism will be next described.

On the shaft D is a loose pulley D', which in practice is belted to a suitable drive shaft and rotated constantly. The pulley and shaft are provided with companion clutch members of the same construction as the clutch upon the shaft C, before described. The clutch-shipping mechanism comprises a rock-shaft D², journaled toward opposite ends in the cheeks and carrying beyond the cheek A⁵ (see, for example, Figs. 1 and 4) a crank D³, which is pivotally connected to the lower end of a rod D⁴, connecting at its upper end with a clutch-shipping bell-crank lever D⁵.

On the rock-shaft D², beyond the cheek A⁵, is an arm D⁶, at its end affording a cam which projects into the path of a pin D⁷, carried by the ratchet-wheel L'. On the cheek A⁵ and connected at its lower end with the crank D³ is a spring D⁸, which tends normally to raise the crank D³ and rod D⁴ and produce disengagement between the clutch members. It will be understood that disengagement of the clutch members is produced by inward pressure upon the push-pin *a*, (indicated by dotted lines in Fig. 4,) and engagement of the clutch members is brought about by releasing the push-pin *a*. As this is a common construction and is only one of many forms of clutch which might be employed in this connection, detail illustration of the working parts is thought to be unnecessary. The spring D⁸ operates to raise the rod D⁴ and press the bell-crank lever D⁵ into the path of the pin

a, whereby the said pin is pressed inward and the pulley D' rotates idly upon the shaft.

In operation when the pin D^2 on the ratchet-wheel strikes the arm or cam D^6 it rocks the shaft D^5 to swing down the crank D^7 against the resistance of the spring D^8 and draw the rod D^9 downward to swing the bell-crank lever D^{10} out of engagement with the pin a, whereby the latter springs in the outward direction and produces engagement between the clutch members and the shaft D is revolved by the pulley D'. As soon as the pin D^2 wipes past the cam D^6 the parts are turned by the spring D^8 to normal position, whereby when the pin a arrives at the lever D^{10} it is depressed and the shaft D stops. Thus the said shaft is given but one revolution with each operation.

Carried by the shaft D near one end adjacent to the cheek A^2 is an eccentric D^3, and the shaft is provided between the cheeks with a longitudinally-extending spline or feather D^4. (See Fig. 5.) Below the shaft D and journaled at opposite ends in the cheeks is a rock-shaft D^{11}, having a crank-arm D^{12}, connected by means of a connecting-rod D^{13} with the eccentric D^3. Extending parallel with the shaft D is a rock-shaft R, journaled at opposite ends in the cheeks in the positions shown. Extending between the cheeks parallel with and just back of the bar A^{10} is a rod A^{11}. Fastened against the back plate M' of each staple forming and driving device is a sleeve R', provided with a perforated ear R^1, which receives and slides upon the rod A^{11}, the latter operative as a supporting-guide to steady the sleeve and at the same time permit its adjustment with the staple forming and driving device. Extending through and journaled in the sleeve R' is a rock-shaft R^2, provided in one side with a gradually-reduced wire-guiding slot e, (see Fig. 18,) the end of the slot nearest the staple forming and driving device being reduced nearly to the diameter of the strengthening-wire Z^2. The said end of the slot is just back of the path of the center of the staple-driver, so that a wire Z^2 passed through the guide-slot e will be in position to be straddled by staples as they are driven. Fastened against the end of the sleeve and extending part way across [fol. 1285] the end of the rock-shaft R^2 is a stationary knife R^4, Figs. 7 and 18. On the opposite end of the rock-shaft R^2 is a crank-arm R^5, pivotally connected at its free end

portion with an upwardly extending rod R'. Adjustably fastened upon the rock-shaft R are backward-extending arms R², (see Fig. 5,) which correspond in number with the staple forming and driving devices. In the under side of each arm R² where it rests upon the shaft D, as shown, is a recess affording an abrupt shoulder c'. A spring c², fastened for convenience at one end to the shaft D', connects at its upper end with one of the arms R² and tends to press all the said arms downward upon the shaft D. On the shaft D' and adjustable longitudinally thereon are brackets S, each formed with two arms S' S². The brackets S correspond in number with the staple forming and driving devices, and the arm S' of each carries a rod S³ for a length of strengthening wire Z. Each arm S² carries a gripping dog S⁴, as shown, for example, in Fig. 2. The dog S⁴ grips the wire Z when the bracket is rocked in the downward direction, as hereinafter described, and releases the said wire when the bracket is rocked in the upward direction. On the end of each sleeve E' is a pivotal dog e', (see Fig. 18,) which grips the wire Z under any strain of the latter in the reverse direction and prevents its being withdrawn from the guide e without interfering with its advancement through the said guide. Fastened at opposite ends, respectively, to the shaft R and rods S³ are springs S⁵, which tend to maintain the rods and brackets S raised.

In operation when the pin D⁴ on the ratchet wheel L wipes across the arm or cam D² and turns the latter, as described, the drive pulley D' clutches the shaft D and causes the latter to rotate. In its rotation its leather D⁵ operates as a cam to raise the arms R² and through the rods R³ and cranks R⁴ to turn the rock-shafts R' across the knives R⁵, thus severing the wires Z. This severing takes place in practice just after the end of a completed blank has passed from beneath the staple forming and driving devices, whereby the wires left upon the blanks extend, say, two inches beyond the rear edge of the blank. Immediately following this severing operation the spline on the shaft D passes the abrupt shoulders c' of the arms R², causing the springs c² to pull down the arms by rocking the shaft R, and thus turn the rock-shaft R' to their initial positions, wherein the ends of the guide-openings

, are clear of the knives R'. The shafts are so geared together that just as the rock-shafts R' return to their initial positions the shaft D'' is rocked by the eccentric D' to swing the brackets S downward and force the wires Z' forward through the guides *c*, whereby the ends of the wires will project, say, three inches beyond the staple-drivers. In the last half of the rotation of the shaft D the brackets S and reels are swung upward again to normal position, the wires Z' being held against retraction by the dogs *c'*.

Journaled at opposite ends in the cheeks in the positions shown are shafts V V'. Beyond the cheek A' the shaft V carries a gear-wheel V', which meshes with the gear-wheel L', and beyond the cheek A' the same shaft carries a gear-wheel V'', which meshes with a similar gear-wheel V''' on the shaft V'. Feathered upon the shaft V are feed-rollers V, and feathered upon the shaft V' are feed-rollers V''. The rollers V'' V'' form companion feed-rollers the lines of which are in the plane of the sheet Z as the latter passes backward from the staple forming and driving devices. The shaft V' is journaled at opposite ends in vertically movable boxes V''' in the cheeks, whereby the upper feed-rollers have slight vertical play. Fulcrumed upon the inner sides of the cheeks and resting normally upon the shaft V' are levers V'', provided upon their free ends with weights V'', which tend to press the feed-rollers V'' downward upon the feed-rollers V''. The speed of rotation of the rollers V'' V'' at their peripheries corresponds with that of the feed-chains, and the said rollers assist the feed-chains in advancing the material beneath the staple-drivers and discharge the completed blanks from the machine.

In order, as before stated, that staples may not be driven at points along the sheet and cleats where step miter-cuts are afterward to be made, I provide skipping mechanism which operates to accelerate the action of the intermittent feed mechanism when those points pass the staple-drivers.

The skipping mechanism will be next described. In the outer side of the ratchet-wheel L', near its periphery, is an annular groove *d*, T-shaped in cross-section. T T are segmental plates, each formed of two relatively-sliding overlapping sections *d' d''*, whereby they may be lengthened

and shortened as desired. Each section is upon a bolt d', having a head which fits and slides in the T groove d. All the segmental plates may be extended to fill out the circumference of the ratchet wheel, and at their peripheries they project slightly beyond the circumference of said wheel, as shown, for example, in Figs. 25 and 26. The plates may be contracted by sliding their sections upon each other to open spaces between the plates at any desired points around the ratchet-wheel. Journaled upon the sleeve L' is an arm T', pivotally connected at its free end with the lower end of a reciprocal rod T, which at its upper end is pivotally and adjustably connected with the lever L at the slot q' in the latter. The connection between the rod T and lever L is near the free end of the latter. The arm T' carries a dog T, which rides upon the periphery of the segmental plates T and at the spaces between said plates drops into engagement with the teeth of the ratchet-wheel L'. The short and abrupt engaging [fol. 1286] stops H' on the feed-chains are farther apart than the length of the longest blank which the machine is adapted to make, and the gearing between the ratchet-wheel L' and feed-chains is such that the said wheel performs a complete revolution to move the feed-chains a distance equal to the distance between two of their stops H'.

The adjustment of the stripper mechanism is effected in the following manner. Presuming, for example, that the box to be ultimately made is to be two feet square, and Z' a trifle over eight feet long and a sheet of corresponding length would be fed to the machine. The segmental plates T would then be adjusted upon the ratchet-wheel to leave open spaces at points to be engaged by the pawl T' at the end of every two feet of travel of the material when it is engaged and advanced by the stops H' after the material has been positioned by the sheet striking the tripping-lever R', as before described. Thus in the reciprocation of the rod T and pawl T' each time the pawl T' strikes into an open space and engages the ratchet-wheel L' the latter will be moved by the said pawl. Owing to the fact that the rod T is fastened toward the free end of the lever L', its plunge is correspondingly greater than the plunge of the rod D' and pawl D', which normally operate the intermittent feed. Therefore each time the

pawl T' engages the ratchet-wheel the latter is moved, say, twice the normal distance, and thus feeds the sheet and cleats twice the distance between operations of the staple-driving devices. This causes the points at which the stepmiter cuts are to be made to be skipped, as indicated in Figs. 35 and 36, no staples being driven thereat. The pin D, before described, upon the ratchet-wheel is adjustable in a T slot d' therein and may be shifted to any desired position and tightened. The said pin is adjusted to strike the lever D' and operate the strengthening-wire cutters and feeders when the blank has passed a predetermined distance beyond the staple forming and driving devices.

After the strengthening wires have been cut it is necessary to stop the machine preparatory to feeding the next cleats and sheet. The stopping of the drive-shaft C is effected by means of a pin *b* (see, for example, Fig. 25) on one of the segmental plates T, which in the rotation of the ratchet wheel and segmental plates thereon strikes the lever E' and releases the rod E, whereby it is drawn downward by its spring and moves the arm E' into the path of the pin *c* at the clutch members between the shaft C and its driving-pulley C'. The pin *b* may be adjusted to any desired position by proper adjustment of the segmental plate which carries it and should be in a position to bring about movement of the arm E' into the path of the pin *c* in such a manner that there will be sufficient after-rotation of the shaft C before stopping to move the staple forming and driving devices upward out of engagement with the blank material and wipe the pin *b* past the lever E'.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a machine for forming box-blanks, the combination with sheet and cleat guides and tacking devices, of intermittent feed mechanism for the sheets and cleats geared with relation to the tacking devices to advance the sheet and cleats intermittingly while the tacking devices are in operation, preliminary feed-operating mechanism comprising gear mechanism which may be thrown at will into operative engagement with the said intermittent feed mechanism to advance the sheet and cleats in their

guides to the tacking devices, and preliminary feed disengaging mechanism actuated by the advance of the blank material to the tacking devices to stop the preliminary feed, substantially as and for the purpose set forth.

2. In a machine for forming box blanks, the combination with sheet and cleat guides and tacking devices, of feed belts at the guides for the sheet and cleats, geared with relation to the tacking devices to advance the sheet and cleats intermittingly while the tacking devices are in operation, preliminary feed operating mechanism comprising gear mechanism which may be thrown at will into operative engagement with the feed belts to advance the sheet and cleats in their guides to the tacking devices, and preliminary feed disengaging mechanism actuated by the advance of the blank material to the tacking devices to stop the preliminary feed, substantially as and for the purpose set forth.

3. In a machine for forming box blanks, the combination with feed and cleat guides and tacking devices, of feed wheels toward opposite ends of said guides, endless belts on said wheels provided with sheet and cleat engaging projections, a gearing between said wheels and the tacking devices operating when the tacking devices are actuated to advance the belts with the sheet and cleats intermittingly, preliminary feed operating mechanism comprising gear mechanism which may be thrown at will into operative engagement with the wheels to move the feed belts and advance the sheet and cleats in their guides to the tacking devices, and preliminary feed disengaging mechanism extending into the path of the blank material at the tacking devices, substantially as and for the purpose set forth.

4. In a machine for forming box blanks, the combination with sheet and cleat guides and tacking devices, of feed wheels toward opposite ends of said guides carrying belts, endless belts extending around said wheels, along the guides and carrying sheet and cleat engaging projections, a gearing between the tacking devices and belt wheels operating when the tacking devices are actuated to turn said shafts intermittingly, an independent driving lever mechanism movable at will to throw and drive said shaft

[p. 1387] into operative engagement with the belt-wheel shafts to advance the sheet and cleats in their guides to the tacking devices, and a said lever mechanism-releasing stop in the path of the blank material to be engaged thereby and actuated to cause said lever mechanism to release engagement between the drive shaft and belt wheel shafts when the material reaches the tacking devices, substantially as and for the purpose set forth.

3. In a machine for forming box blanks, the combination with intermittent feed mechanism for the blank material, of a drive shaft, cross heads operatively geared to the drive shaft at different angles with relation to said shaft, a staple forming and driving device, adjacent to the path of the blank material having a staple forming bar and a staple driver cooperating with the forming bar and geared to one said cross head, the staple forming bar being actuated from the other said cross head to be moved thereby during a part only of the movement of the cross head, whereby when the staple is formed the forming bar will remain in one position while the staple driver is moved to discharge the staple therefrom, a staple wire feeder adjacent to the forming bar, and means for guiding a staple forming wire, substantially as and for the purpose set forth.

4. In a machine for forming box blanks, the combination with a drive shaft, cross heads operatively geared to the drive shaft at different angles with relation to said shaft, a staple forming and driving device, adjacent to the path of the blank material having a staple forming bar and a staple driver cooperating with the forming bar and geared to one said cross head, a staple wire feeder adjacent to the forming bar, a staple wire cutter actuated in the rise of the forming bar to sever the staple wire between which staples are formed and from which the forming bar descends to form the staples, the said cutter being normally in the path of the staple driver, means for moving the material in the path of a staple driver in the descent thereof, means for guiding a staple forming wire adjacent to the staple forming and driving device, and intermittent feed mechanism for the blank material operatively geared to the said drive shaft, substantially as and for the purpose set forth.

7. In a machine for forming box-blanks, the combination with feed mechanism for the blank material, of a drive-shaft, cross-heads operatively geared to the drive-shaft, a staple forming and driving device adjacent to the path of the blank material, having a staple-forming bar operatively geared to one of said cross-heads, and a staple-driving device coöperating with the forming-bar and geared to the other said cross-head, a staple-wire feeder adjacent to the forming-bar, a guide for a strengthening-wire, adjacent to the staple forming and driving device, through which the strengthening-wire is drawn by movement of the blank when fastened to the blank, strengthening-wire feeding and severing mechanisms, and means for operating the same only when the end of the blank passes from beneath the staple forming and driving device, substantially as and for the purpose set forth.

8. In a machine for forming box-blanks, the combination of a drive-shaft, a staple forming and driving device adjacent to the path of the blank material operatively geared to the drive shaft, intermittent feed mechanism for the blank material having a ratchet-wheel and a reciprocating pawl actuated from the drive-shaft to turn the ratchet-wheel once with each reciprocation, and skipper mechanism comprising segmental plates upon the ratchet-wheel projecting beyond the ratchet-teeth, a reciprocating pawl actuated from the drive-shaft and riding normally upon said plates and engaging the ratchet-wheel between the ends of said plates only, all constructed to operate substantially as and for the purpose set forth.

9. In a machine for forming box-blanks, the combination of the main drive-shaft, a constantly-rotating pulley upon said shaft, clutch mechanism between the shaft and pulley, clutch-operating mechanism, an operating-lever for said clutch-operating mechanism movable to produce engagement between the clutch members to cause the shaft to be rotated by the pulley, tacking devices geared to said main shaft, a second drive-shaft, feed mechanism for the blank material, an operating-lever movable to throw the feed mechanism into engagement with said second drive-shaft to move the blank material to the tacking devices, means for disengaging the feed mechanism from the said second drive-shaft in the path of the blank material and operating

to produce such disengagement when the material arrives at the tacking devices, intermittent feed mechanism for the blank material having a ratchet wheel and a driving-pawl for said ratchet-wheel reciprocated from the main drive-shaft, and a stop movable with the ratchet-wheel to engage the said clutch operating mechanism and release the clutch members at the main drive shaft, substantially as and for the purpose set forth.

10. In a machine for forming box-blanks, the combination with the main drive-shaft C, a tacking device and pawl and ratchet wheel intermittent feed mechanism for the blank material actuated from the drive-shaft, of a shaft D, rotating means for said shaft normally out of engagement therewith, a guide for a strengthening-wire at said tacking device, strengthening wire feed and severing mechanisms adjacent to said guide and operatively geared to the shaft D, a stop movable with the ratchet wheel, and clutch mechanism between the shaft D and its rotating means, projecting into the path of said stop, whereby in each rotation of the ratchet wheel the shaft D is actuated to actuate [fol. 1288] the strengthening wire feed and severing mechanisms, substantially as and for the purpose set forth.

11. In a machine for forming box-blanks, the combination with intermittent feed mechanism for the sheet and cleats and the staple forming and driving devices, of an anvil beneath each said device to take the impact against a cleat, and a removable staple-clencher with means for securing it to one of said anvils, substantially as and for the purpose set forth.

12. In a machine for forming box-blanks, the combination with intermittent feed mechanism for the blank material, of a drive-shaft, a staple forming and driving device geared to said drive-shaft, comprising a staple-forming bar, a staple-driving bar and means for feeding the staple-wire, of a cutter-block adjacent to the path of the forming-bar, a guide-opening through said cutter-block at an angle to the face of said block, a cutter-knife working across said face, a movable mandrel in the path of the driving-bar, and means for guiding the wire from the cutter-block across the mandrel and beneath the forming-bar comprising a yielding block *i*, provided with a guide-opening *i'*, movable

with the cutter knife, substantially as and for the purpose set forth.

Frederick P. Rosback.

In presence of J. H. Lee, R. T. Spencer.

(Here follow side folios 1289 1342.)

[fol. 1343] United States Patent Office.

Jacob Uhri, of Chicago, Illinois, Assignor to the Wire Bound Box Company, of Same Place.

Machine for Making Box Blanks.

Specification Forming Part of Letters Patent No. 608,809, Dated August 9, 1898.

Application filed November 16, 1895. Serial No. 569,157. (No model.)

To all whom it may concern:

Be it known that I, Jacob Uhri, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Machines for Making Box Blanks, of which the following is a specification.

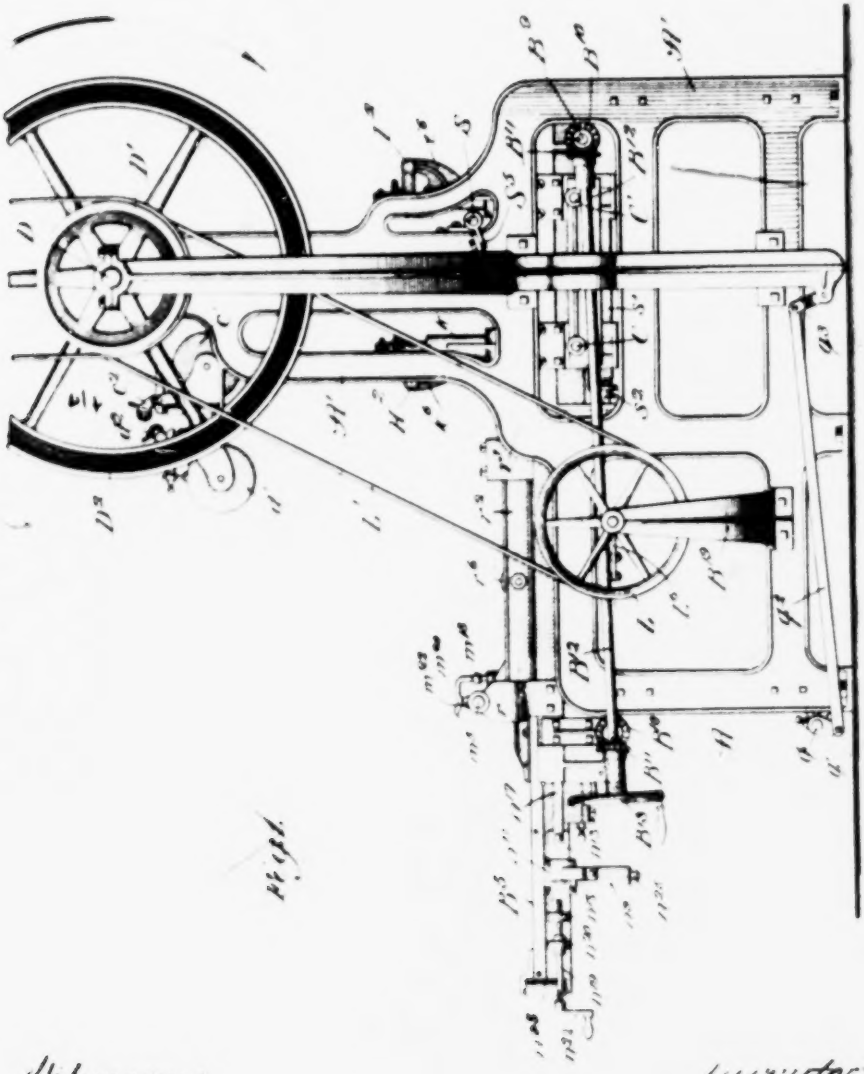
This invention relates to a machine for manufacturing a certain box blank, which is illustrated in the last three figures of the accompanying drawings. Briefly stated, the box blank consists in a thin piece or sheet of wood provided on one face with longitudinally-extending cleats and on its opposite or outer face with strengthening-wires extending parallel with the cleats, the parts being fastened or tacked together by means of staples, which straddle the strengthening-wires and pass through the sheet into the cleats. The sheet and cleats are of a length to form the four sides of a box to be employed as a shipping-case. To permit the box to be formed, the cleats are cut away and step-mitered at the points which form the edges of the box, so that when the blank is folded the step-miters will intermesh. The strengthening-wires extend beyond opposite

No. 608,809. Patented Aug. 9, 1898.

J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

(No Model.) Application filed Nov. 16, 1895. 27 Sheets—Sheet 1.



Witnesses:

Inventor:
Jacob Uhri,
By Crosby & Gregory
Attys.

1291-1292

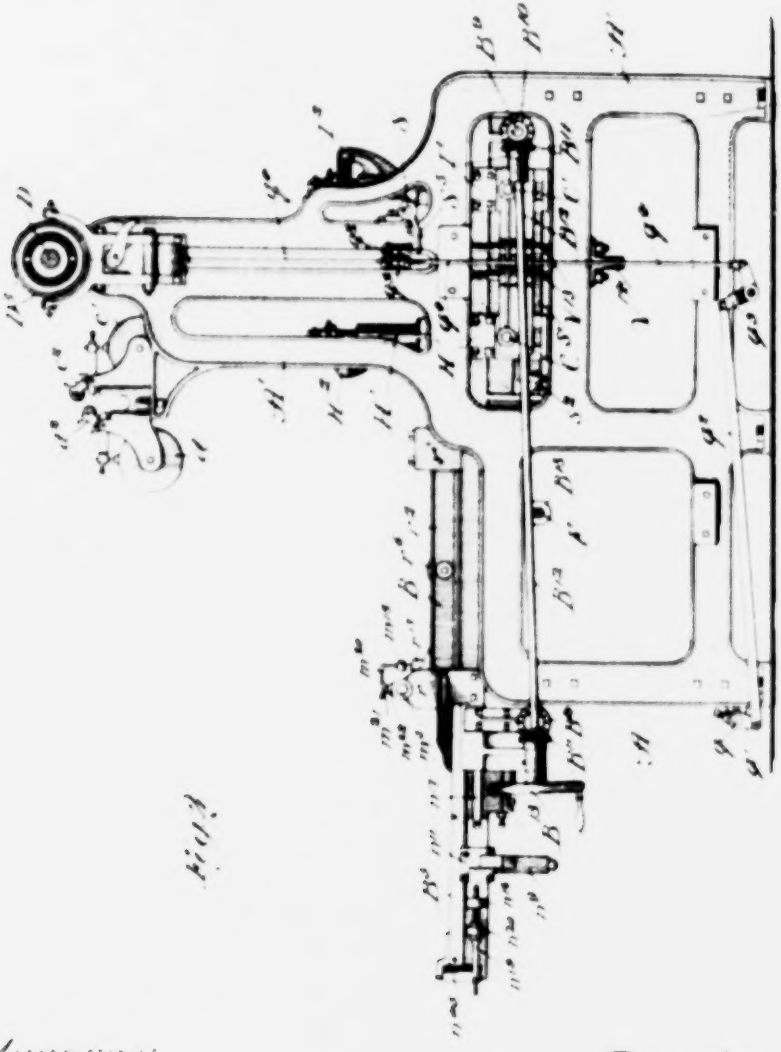
No. 608,809. Patented Aug. 9, 1898

J. UHRI.

MACHINE FOR MAKING BOX BLANKS

Application filed Nov. 19, 1895.

No Model. 27 Sheets—Sheet 2



Witnesses:

Inventor:

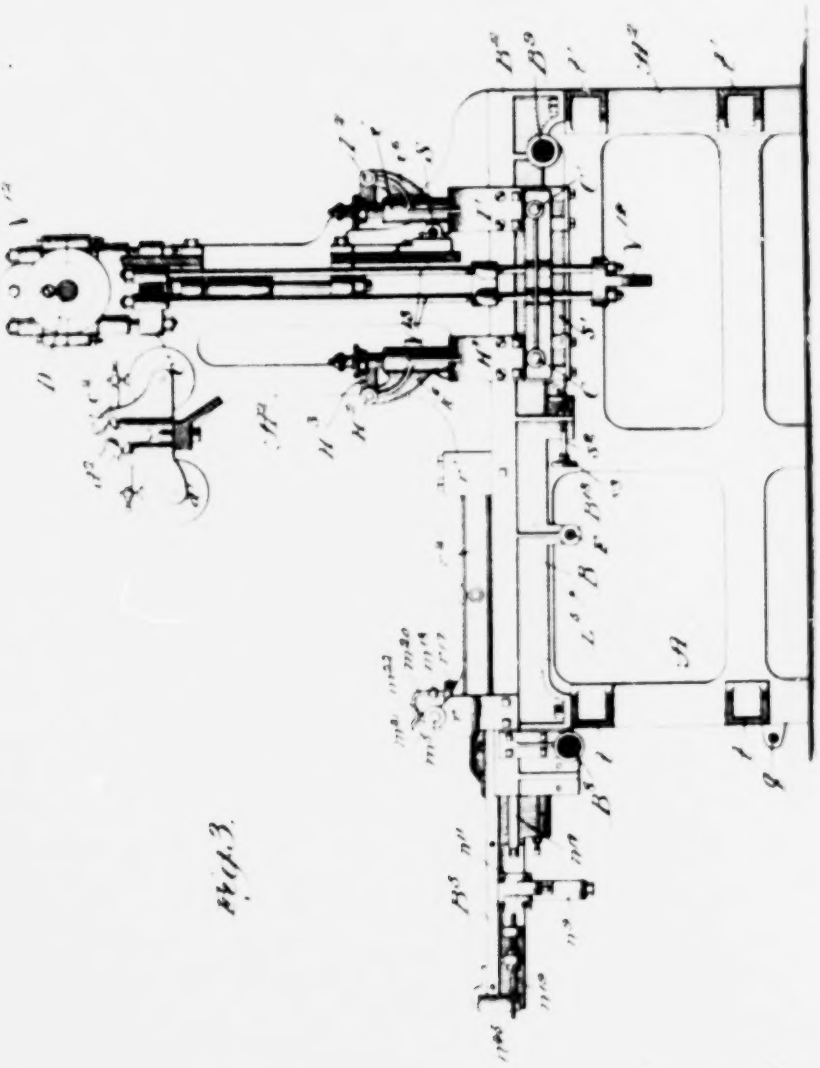
No. 608,809. Patented Aug. 9, 1898.

J. UHRI.

MACHINE FOR MAKING BOX BLANKS

(Application filed Nov. 16, 1897.

(No Model.) 27 Sheets—Sheet 3



Witnesses:

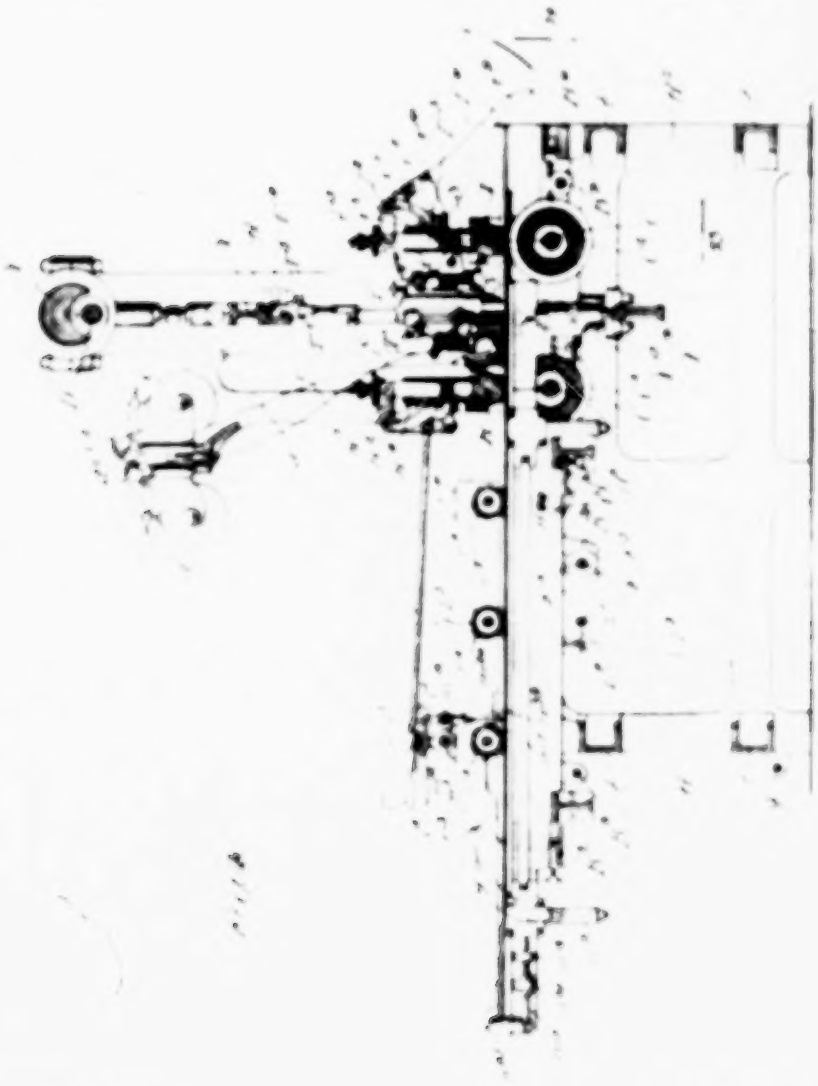
Inventor:
Jacob Uhri.
By Crandall & Dyrenforth,
Attorneys.

1295-1296

No. 608,809 Patented Aug. 9, 1898

J. UNRI

MACHINE FOR MAKING BOX BLANKS

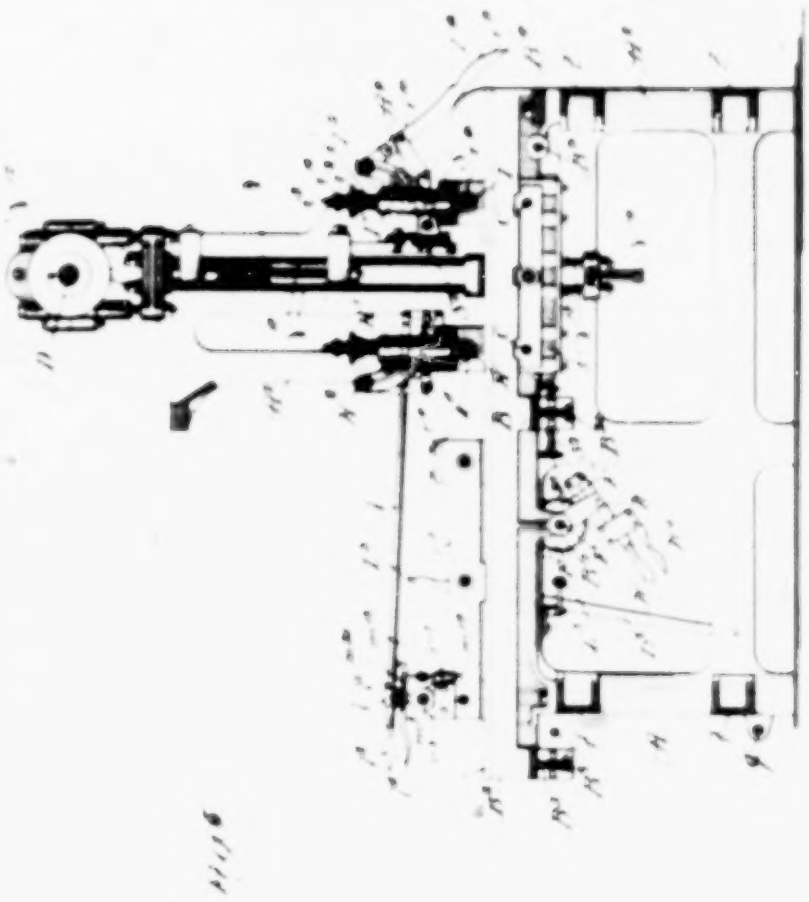


No. 608,809 Patented Aug. 9, 1898.

J. UNDI

MACHINE FOR MAKING BOX BLANKS

No Model. 27 Sheets—Sheet 5.



Witnesses:

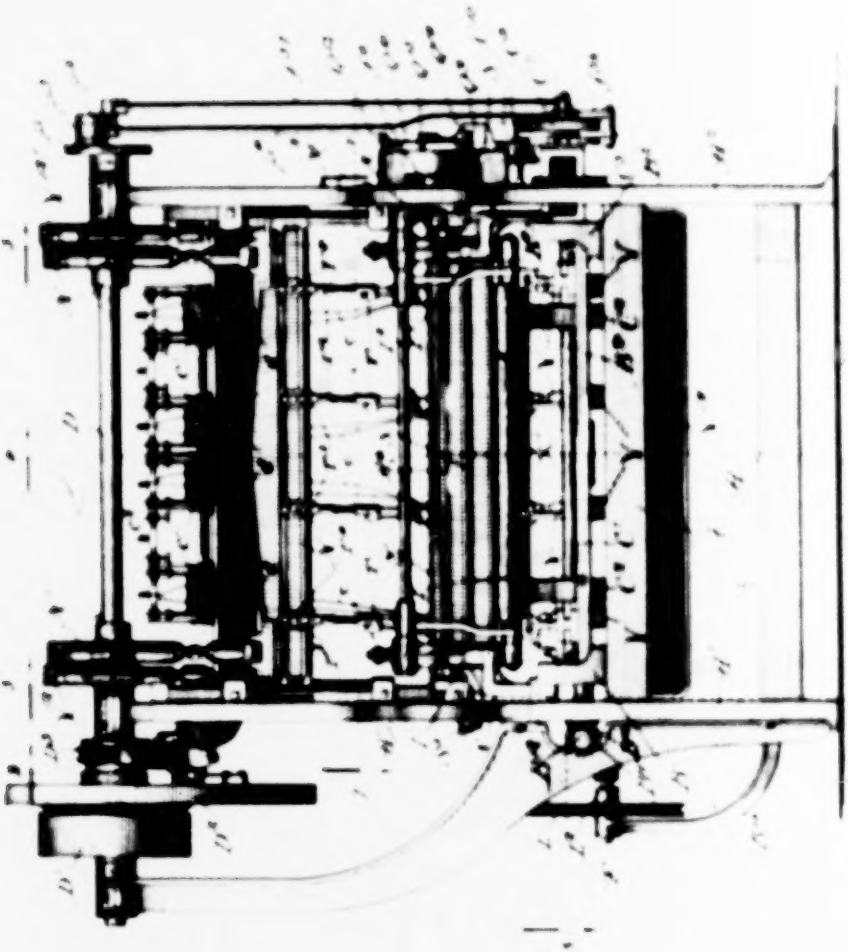
Inventor:

No. 608,809. Patented Aug. 9, 1898.

J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

(No Model.) (Application filed [illegible], 1897.) 27 Sheets—Sheet 1.



Witnesses:

Inventor:

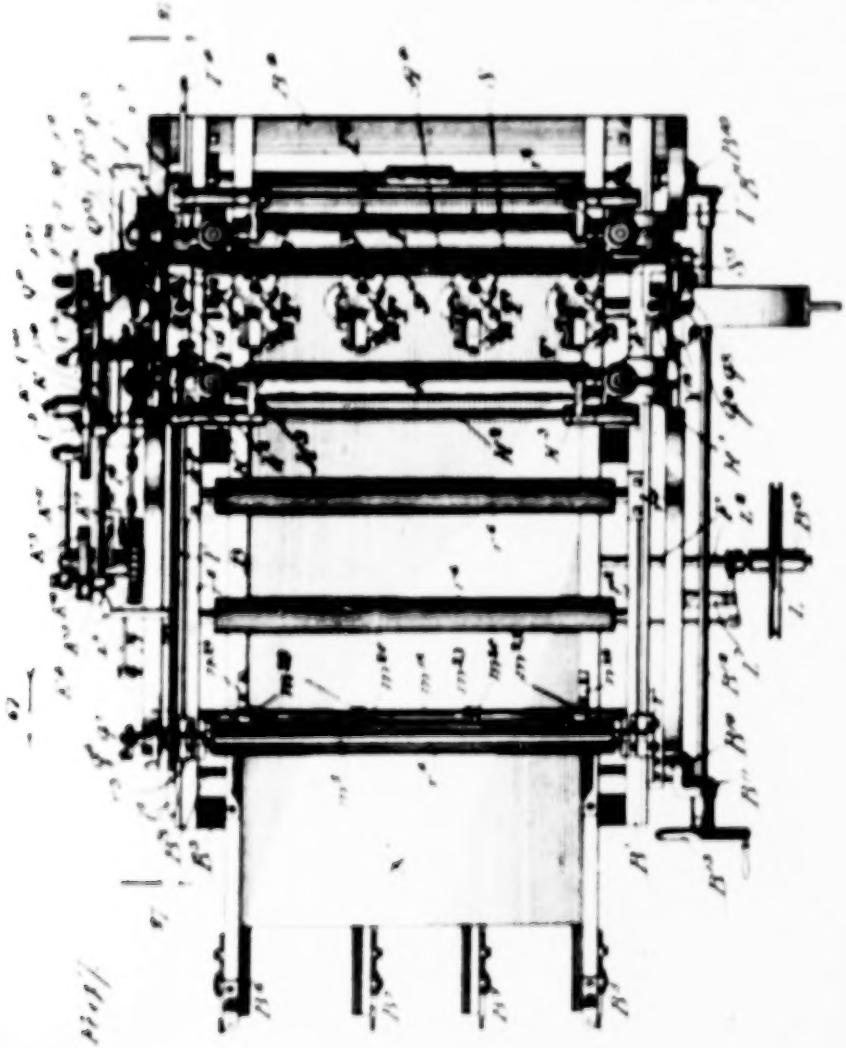
1301-1302

No. 608,809 Patented Aug. 9, 1898

J. UHRI

MACHINE FOR MAKING BOX BLANKS

(No Model.) 17 Sheets—Sheet 7



Witnesses

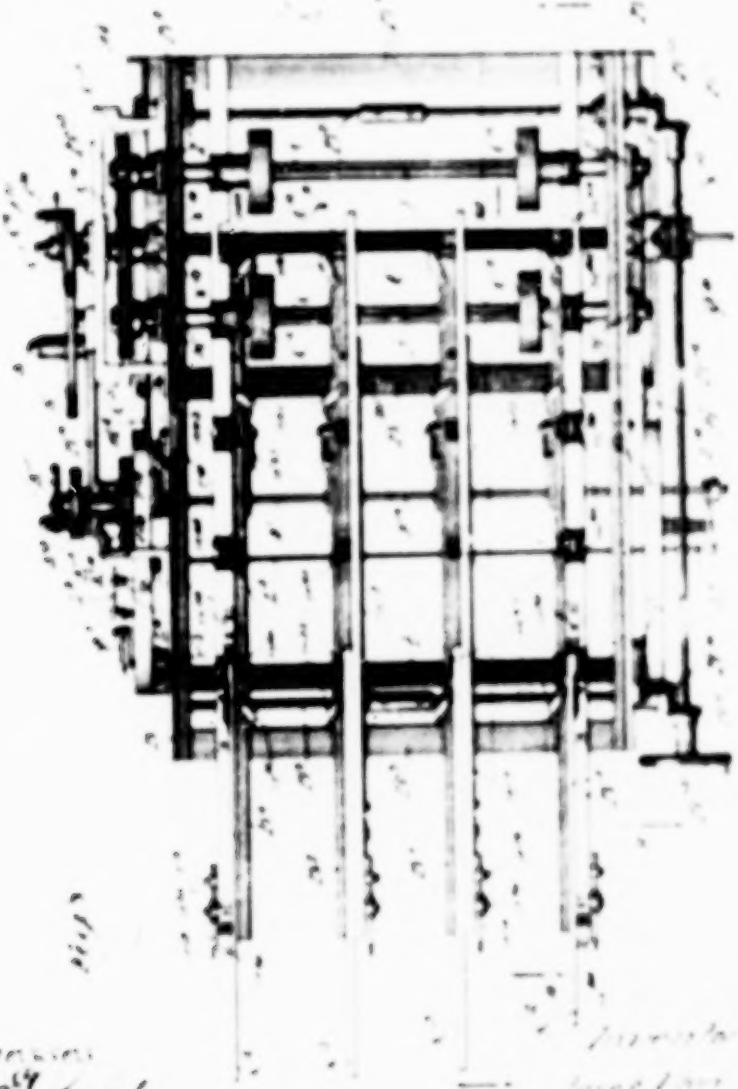
Inventor

No. 608,805 Patented Aug. 9, 1898

J. DYER.

MACHINE FOR MAKING BOX BLANKS.

(No Model.) (2 Sheets-Sheet 1.)



2308-1

No. 508,809 Patented Aug. 8, 1893

J. [illegible]

MACHINE FOR MAKING BOX BLANKS

No. Model. 21 Sheets-Sheet 1

1307-1308

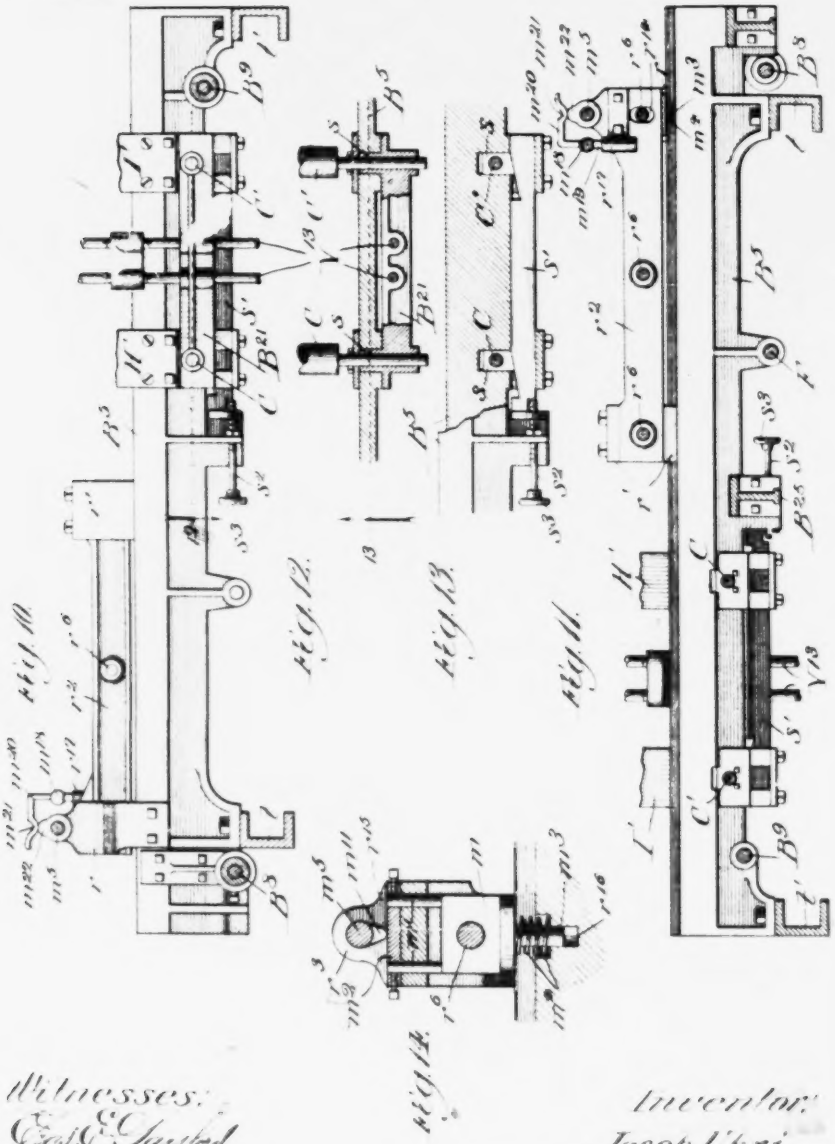
No. 608,809. Patented Aug. 9, 1898.

J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

(Application filed Nov. 16, 1895.)

(No Model.) 27 Sheets—Sheet 10.



Witnesses:
Chas. E. Langford
Wm. J. Miller

Inventor:
Jacob Uhri.
By Dyrenforth & Dyrenforth
Attys.

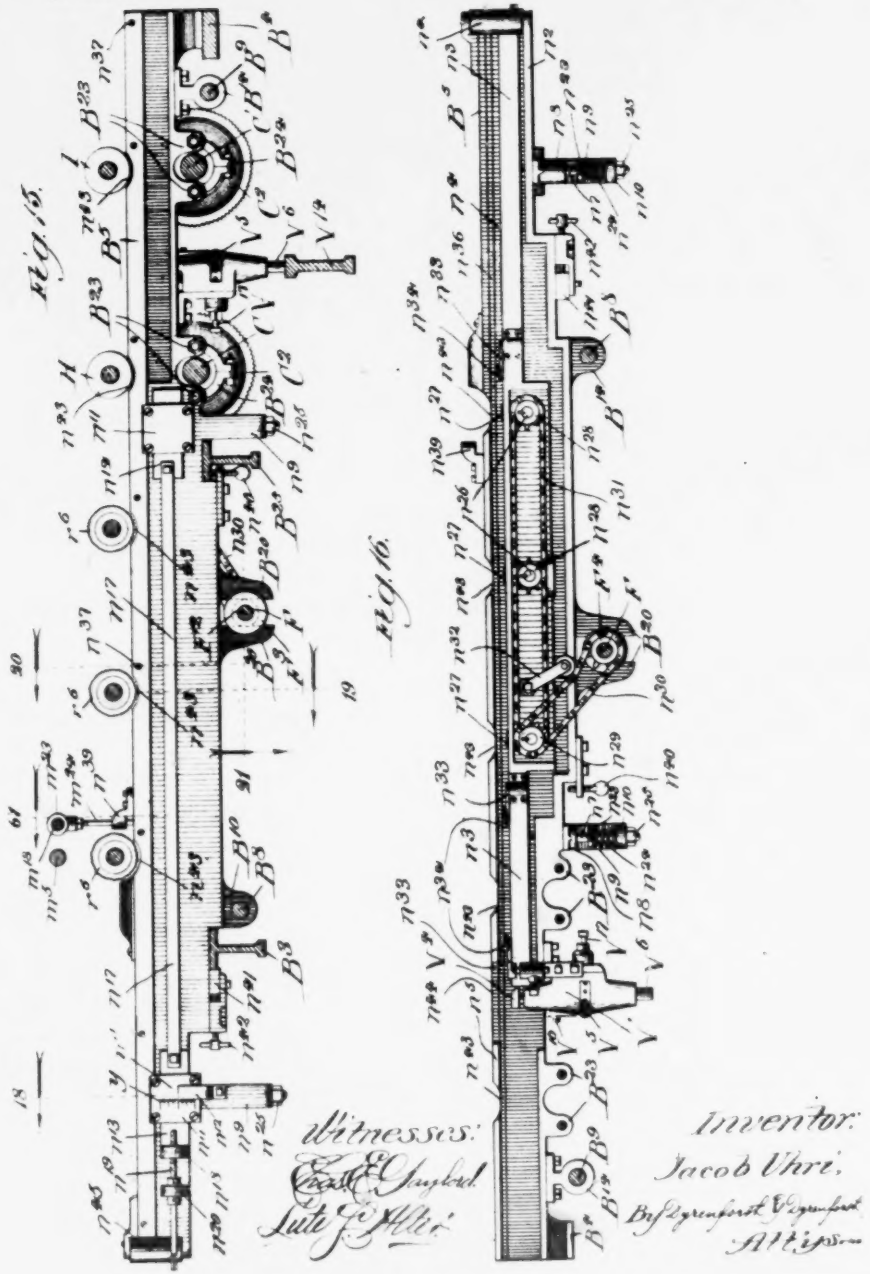
No. 608,809. Patented Aug. 9, 1898.

J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

(Application filed Nov. 16, 1895.)

(No Model.) 27 Sheets—Sheet 11.



Witnesses:
Chas. E. Gaylord
Lute J. Miller

Inventor:
Jacob Uhri,
By Sprague & Sprague
Attys.

1311-1312

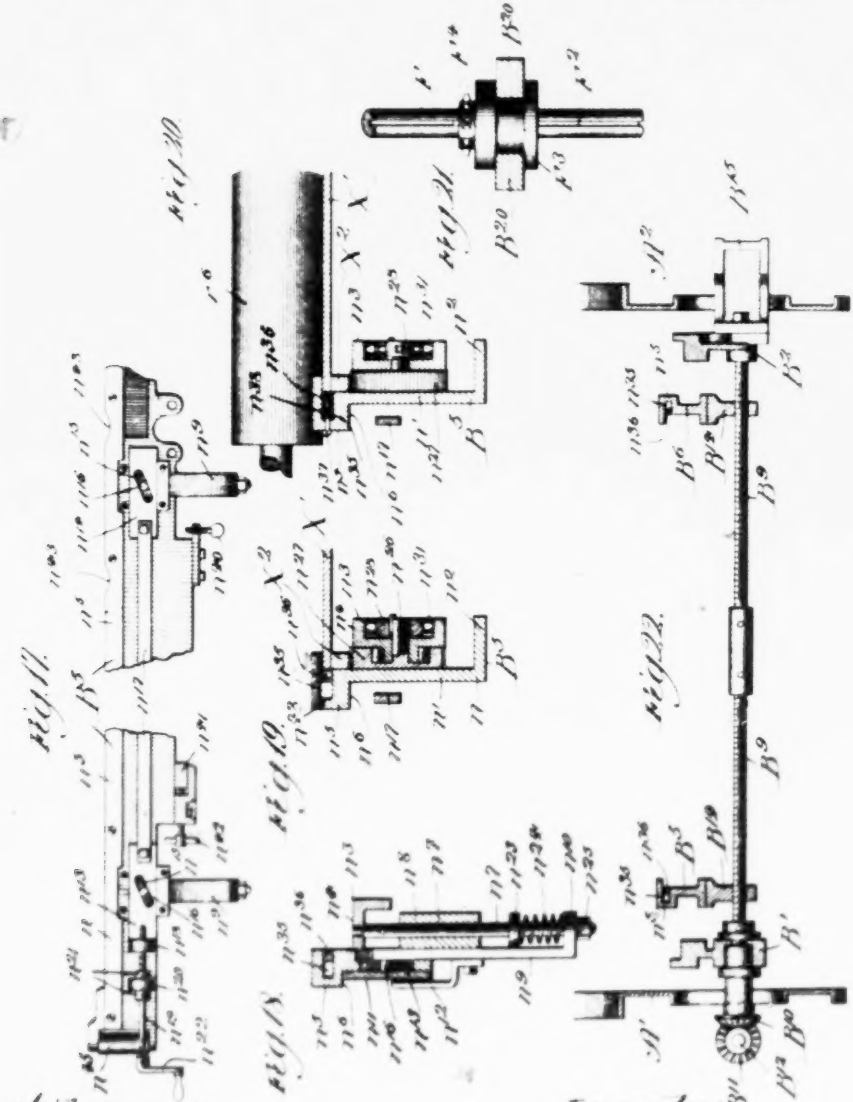
No. 608,809. Patented Aug. 9, 1898.

J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

Application filed Nov. 16, 1895.

(No Model.) 27 Sheets—Sheet 12.



Witnesses:
Chas. E. Gaylord
Luther F. Alter

Inventor:
Jacob Uhri.
By Dyrenforth & Dyrenforth,
Attys.

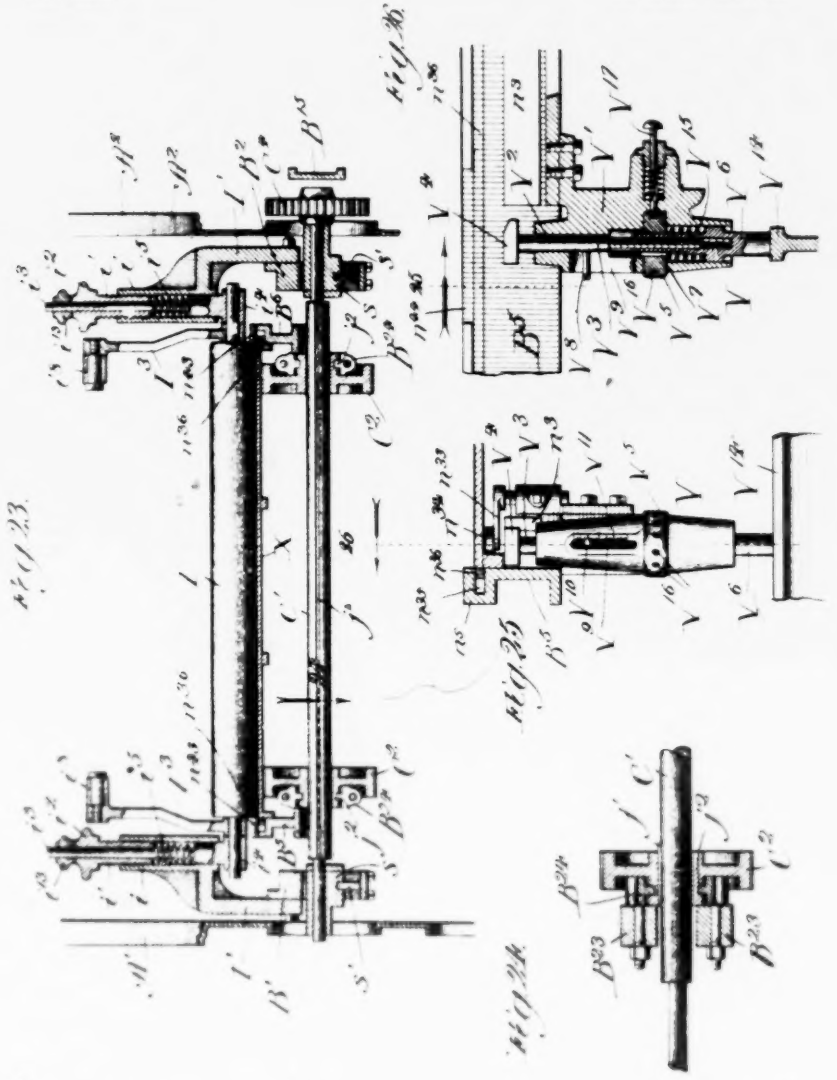
No. 608,809. Patented Aug. 9, 1898.

J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

(Application filed Nov. 16, 1896.)

(No Model.) 27 Sheets—Sheet 13.



Witnesses.
Chas. E. Sanford
Jule J. Uhri

Inventor.
Jacob Uhri,
By Dyrenforth & Dyrenforth
Attorneys.

1315-1316

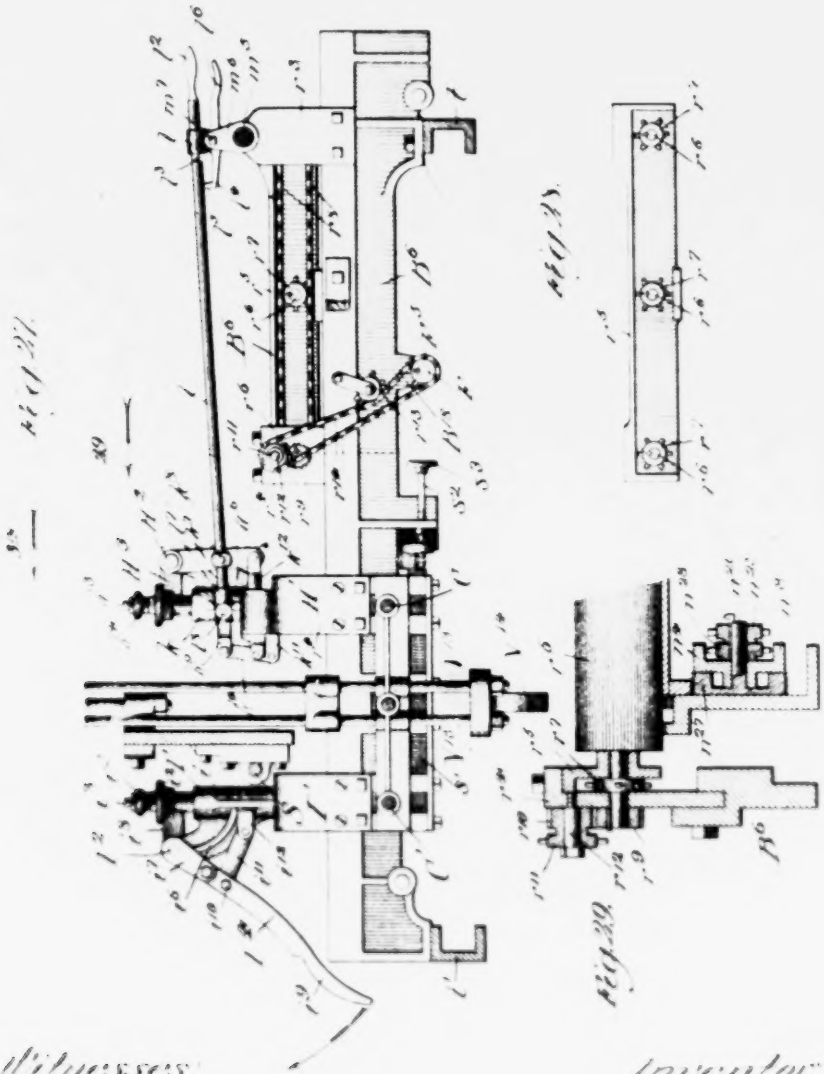
No. 608,809. Patented Aug. 9, 1898.

J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

Application filed Nov. 16, 1896.

(No Model.) 27 Sheets—Sheet 14.



Witnesses:
Geo. E. Hoyt
Jule[illegible]

Inventor:
Jacob Uhri.
By Dyrenforth & Dyrenforth
Attys.

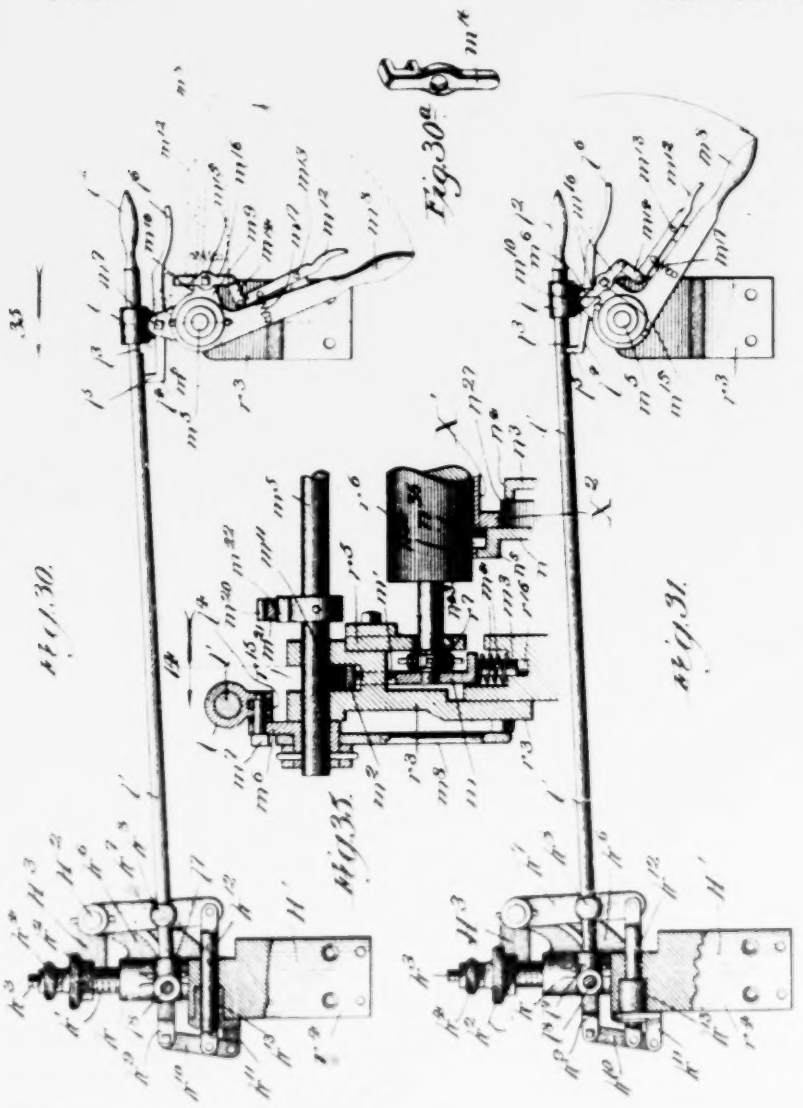
No. 608,809. Patented Aug. 9, 1898.

J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

(Application filed Nov. 16, 1895.)

(No Model.) 27 Sheets—Sheet 15.



Witnesses:
Chas. E. Sargent
Wm. J. Kline

Inventor:
Jacob Uhri.
By Dysinford & Sprague
Attys.

1319-1320

No. 608,809 Patented Aug. 9, 1898

J. UHRI

MACHINE FOR MAKING BOX BLANKS

Application filed Mar. 10, 1897.

(No Model.) 27 Sheets—Sheet 18.

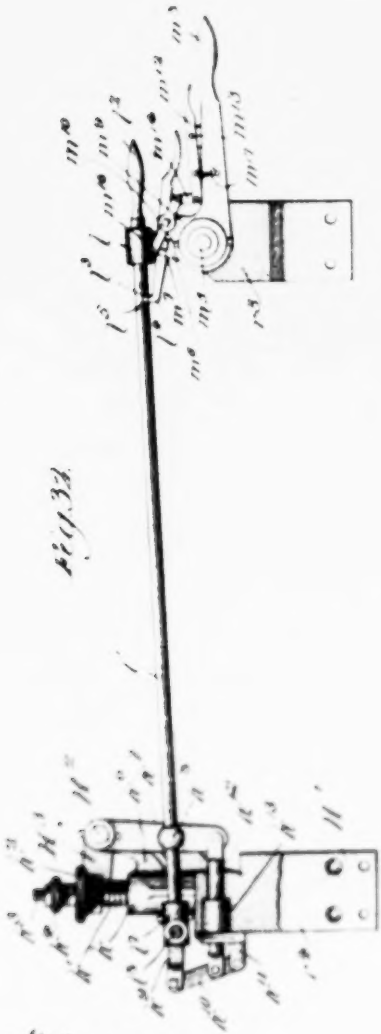


Fig. 32.

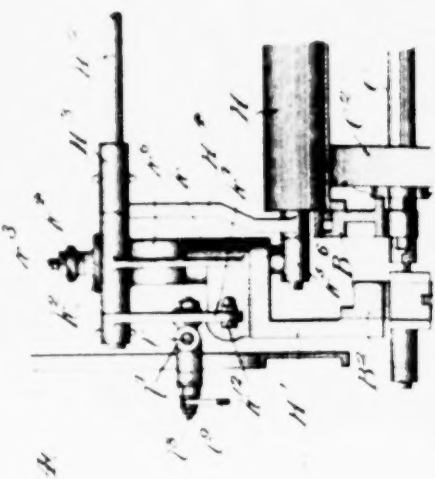


Fig. 34.

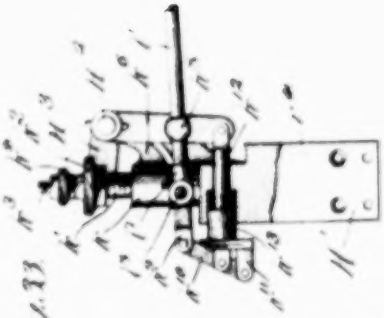


Fig. 33.

Witnesses:
Chas. C. Snyder
Jule J. Bothe

Inventor:
Jacob Uhri.
By Sigmund & Sigmund
Attys.

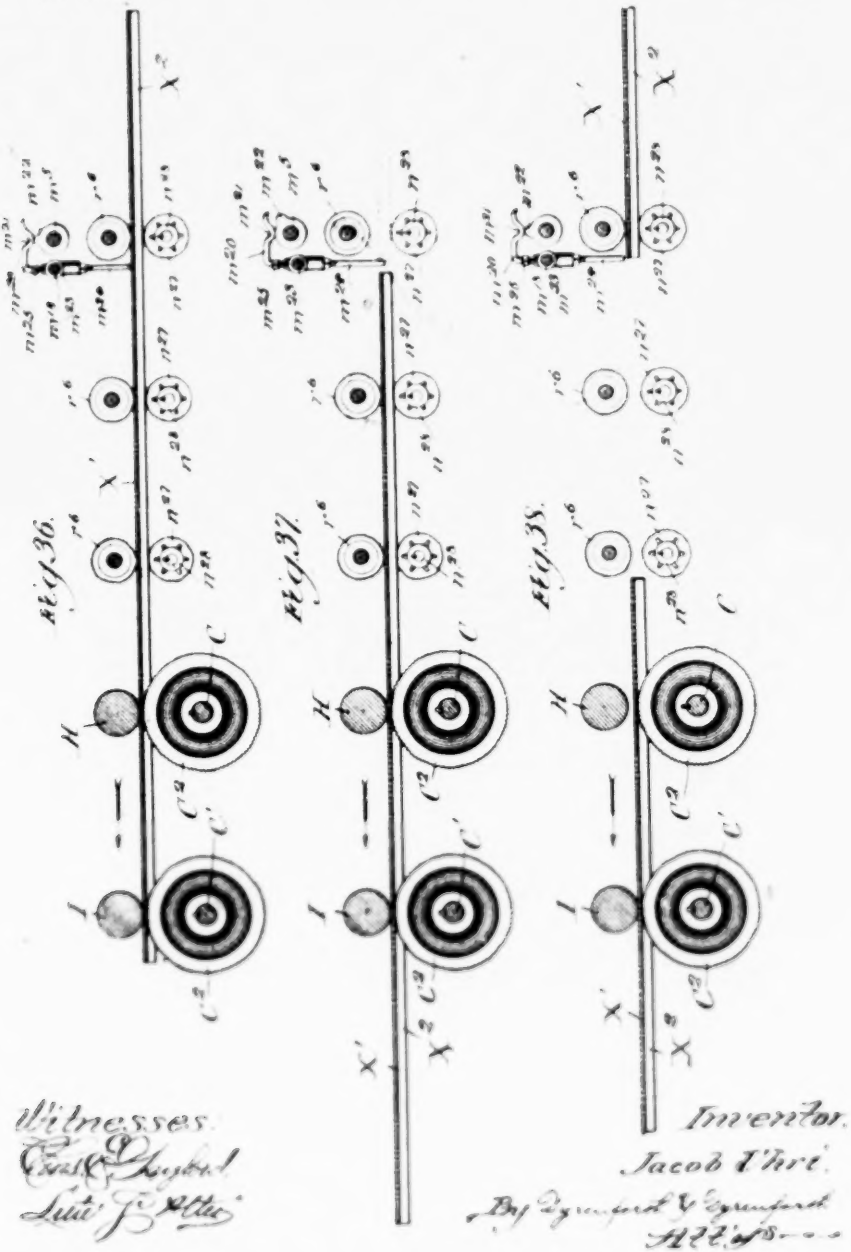
No. 608,809. Patented Aug. 9, 1898.

J. UHRI

MACHINE FOR MAKING BOX BLANKS.

(Application filed Nov. 16, 1896.)

(No Model.) 27 Sheets—Sheet 17



Witnesses.
Chas. D. Seybold
Lutz Fr. Otto

Inventor.
Jacob Uhri.
By Dyrenforth & Dyrenforth
Attys.

1323-1324

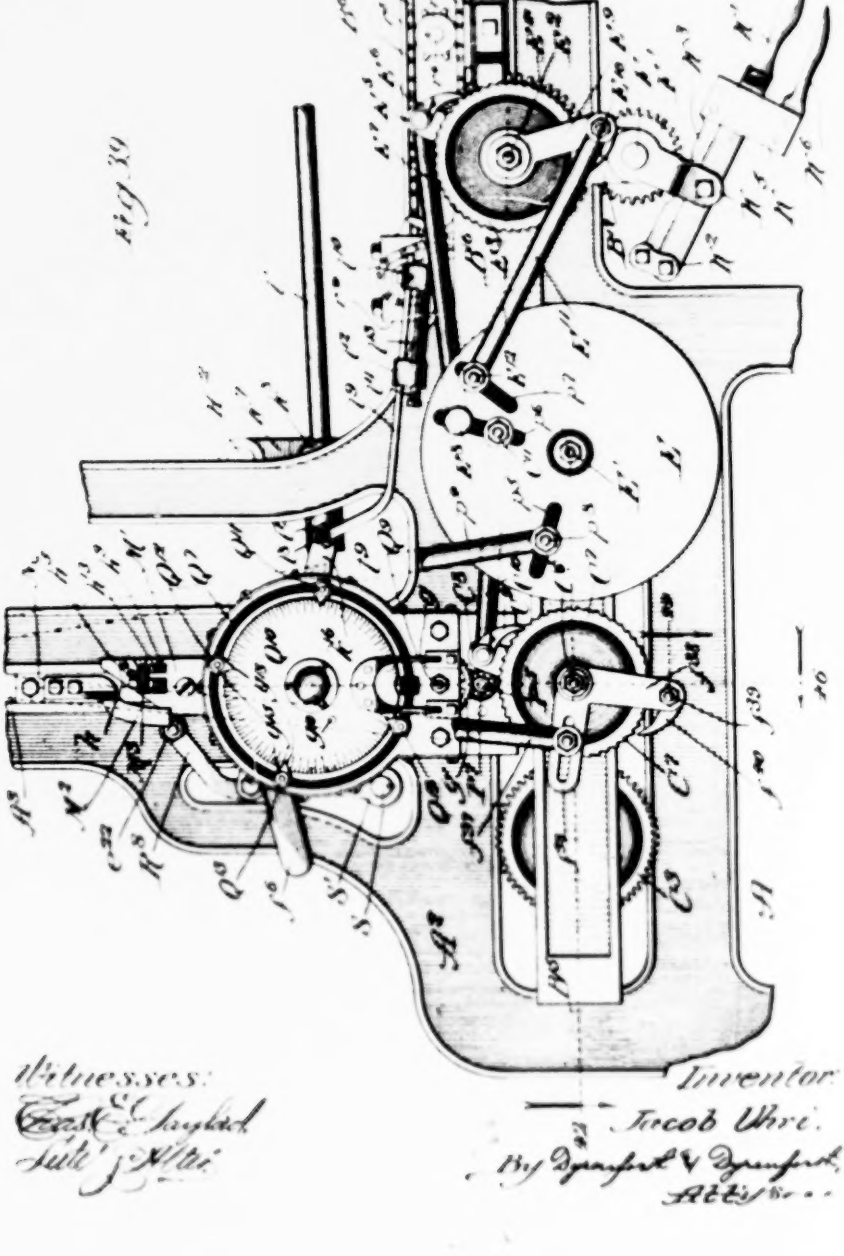
No. 608,809. Patented Aug. 9, 1898.

J. UHRI.

MACHINE FOR MAKING BOX BLANKS

Application filed Nov. 10, 1896.

(No Model.) 27 Sheets—Sheet 10.



Witnesses:
Frank E. Ingold
Luke J. Uhri

Inventor:
Jacob Uhri.
By Dyrenforth & Dyrenforth
Attys.

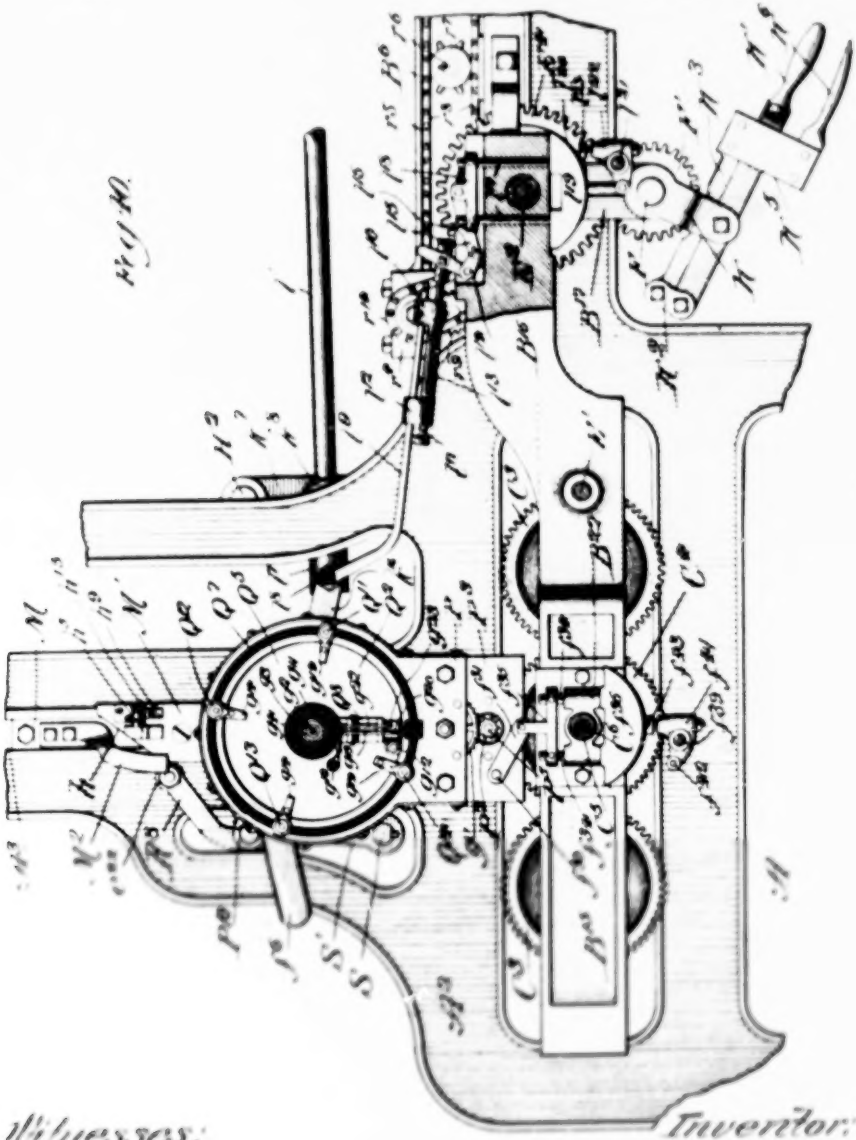
No. 608,809. Patented Aug. 9, 1898.

J. UHRI.

MACHINE FOR MAKING BOX BLANKS

Application filed Nov 10, 1895.

(No Model.) 27 Sheets—Sheet 19



Witnesses:
Chas. E. Langford.
Jule J. Peters

Inventor:
Jacob Uhri.
By Dumford & Dumford
Attys

1327-1328

No. 608,809

Patented Aug. 9, 1898

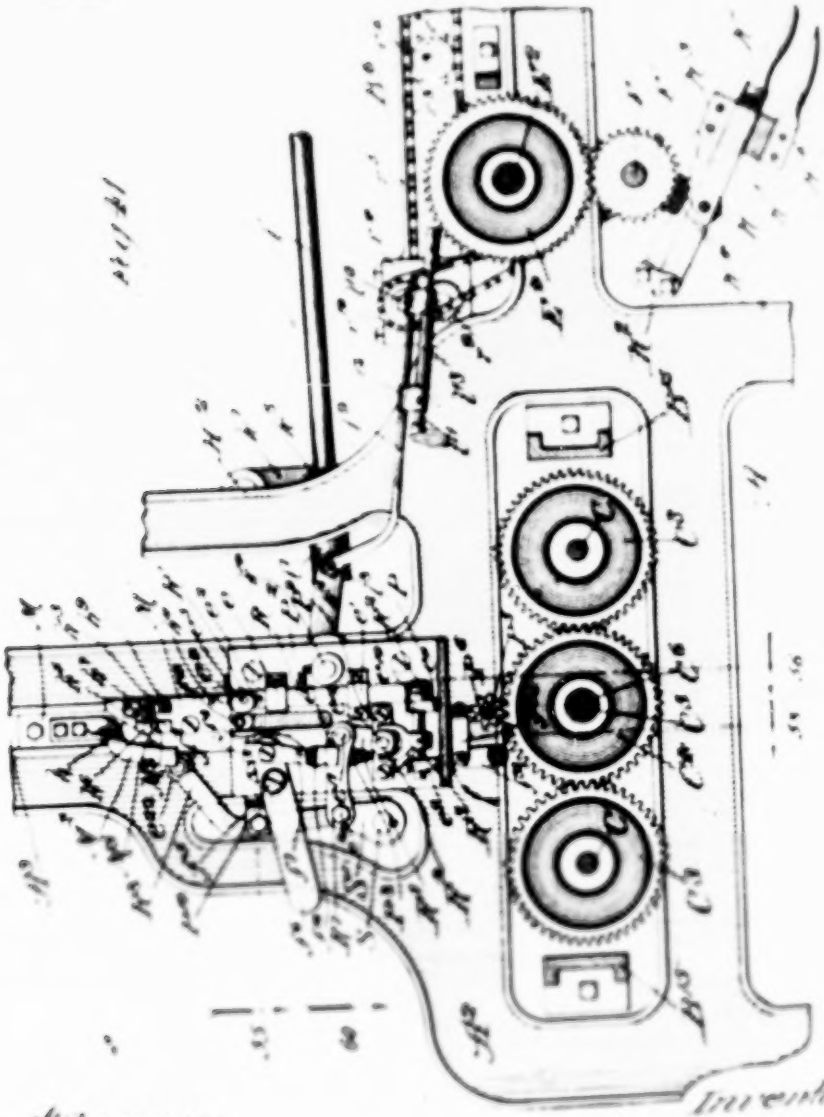
J. UHRI

MACHINE FOR MAKING BOX BLANKS

Application filed Dec. 1, 1897.

(No Model.)

2 Sheets-Sheet 1.



Witnesses.

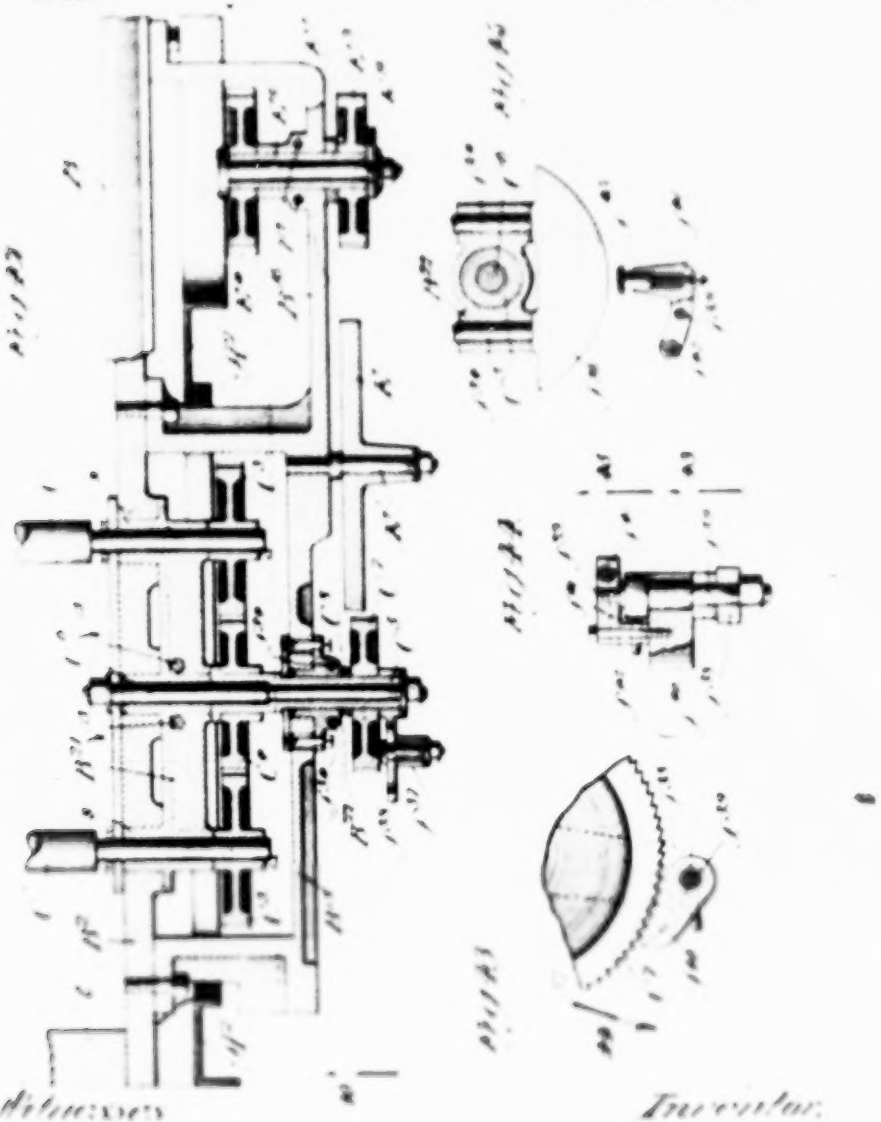
Inventor.

No. 608,509 Patented Aug. 9, 1898

J. UHRI

MACHINE FOR MAKING BOX BLANKS

(No Model.) (2 Sheets-Sheet 2.)



Witnesses:
C. Smith
[illegible]

Inventor:
Jacob Uhri
By [illegible]
Atty.

1331-1332

No. 608,809. Patented Aug. 9, 1898.

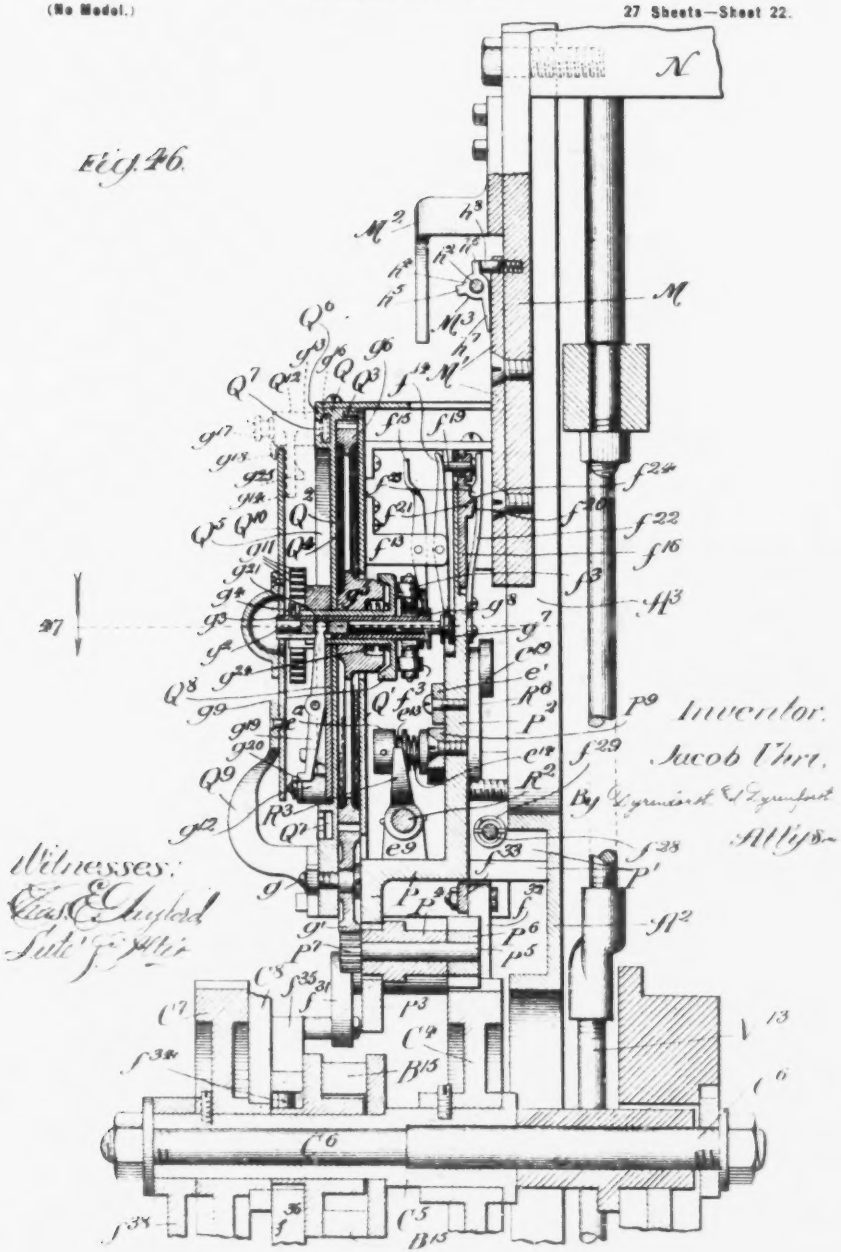
J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

(Application filed Nov. 16, 1895.)

(No Model.) 27 Sheets—Sheet 22.

Fig. 46.



No. 608,809. Patented Aug. 9, 1898.

J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

(Application filed Nov. 16, 1896.)

(No Model.) 27 Sheets—Sheet 23.

FIG. 47.

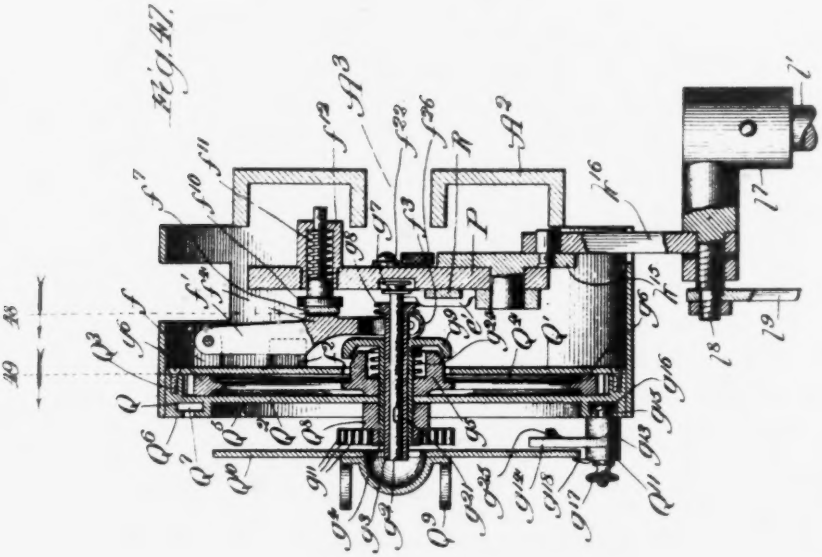


FIG. 48.

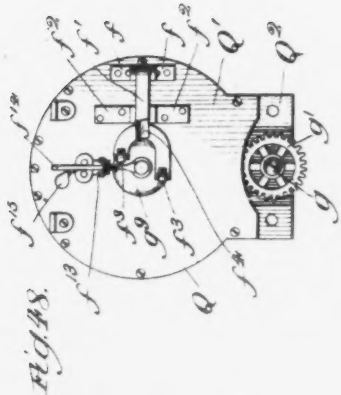
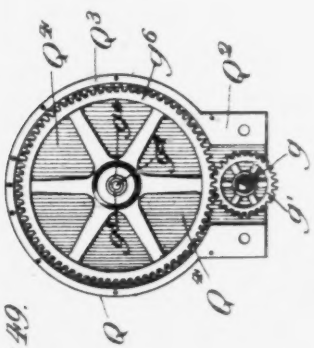


FIG. 49.



Witnesses:
Chas. E. Wayland
Lute. J. Hall

Inventor.
Jacob Uhri,
By Dyrenforth & Dyrenforth
Phillips

1335-1336

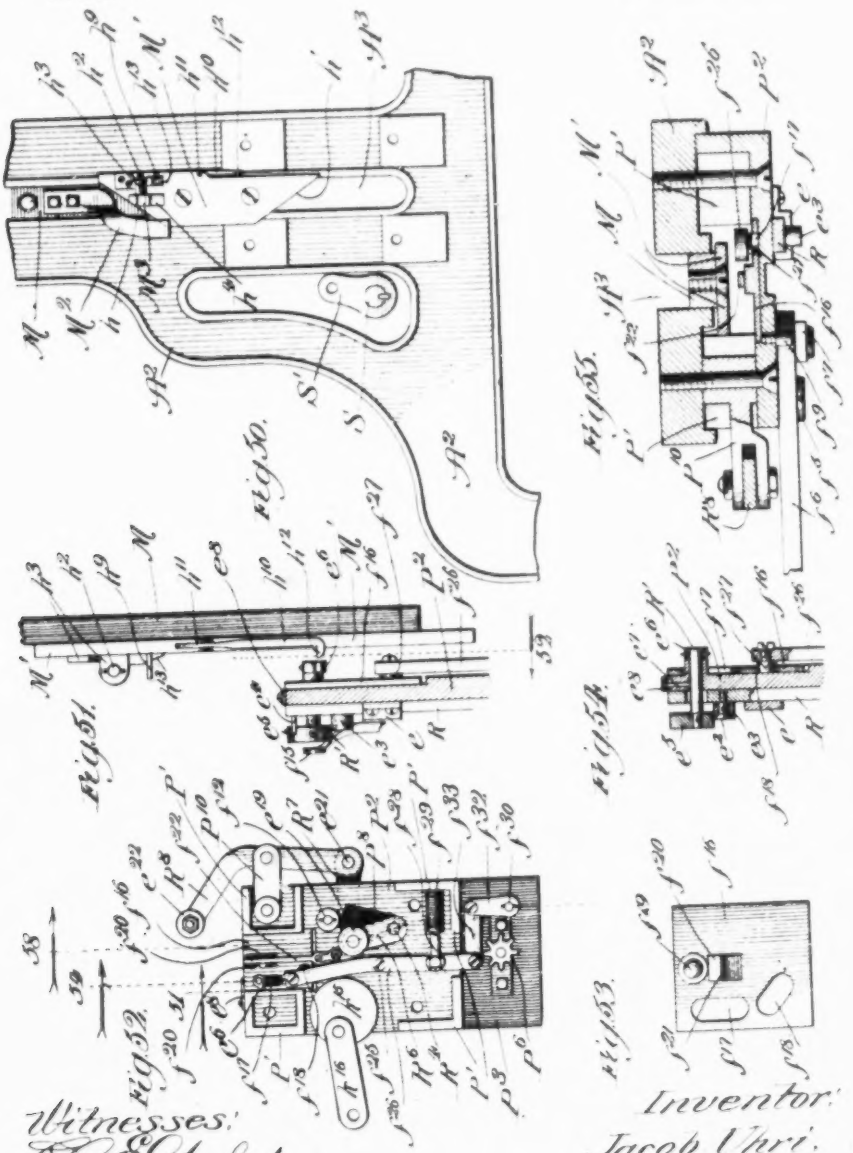
No. 608,809. Patented Aug. 9, 1898.

J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

Application filed Nov. 16, 1896.

(No Model.) 27 Sheets—Sheet 24.



Witnesses:
Chas. E. Gaylord.
Lida J. Hitt.

Inventor:
Jacob Uhri.
By Dewey & Dewey
Attys.

No. 608,809. Patented Aug. 9, 1898.

J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

(Application filed Nov. 16, 1895.)

(No Model.) 27 Sheets—Sheet 25.

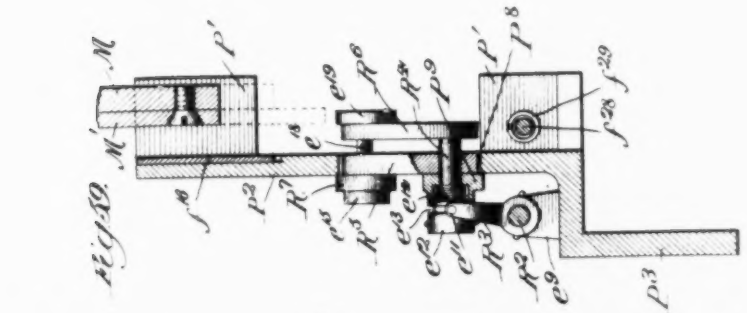


FIG. 156.

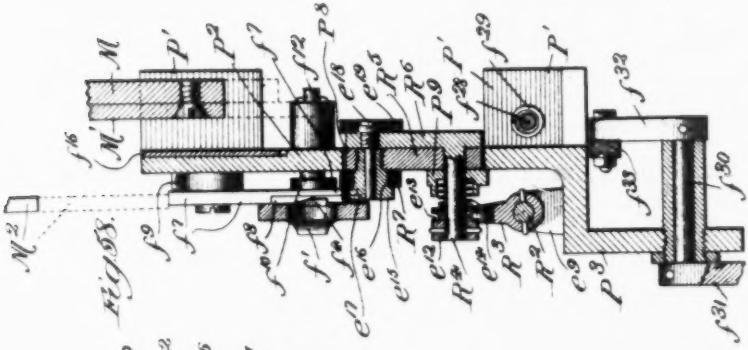


FIG. 155.

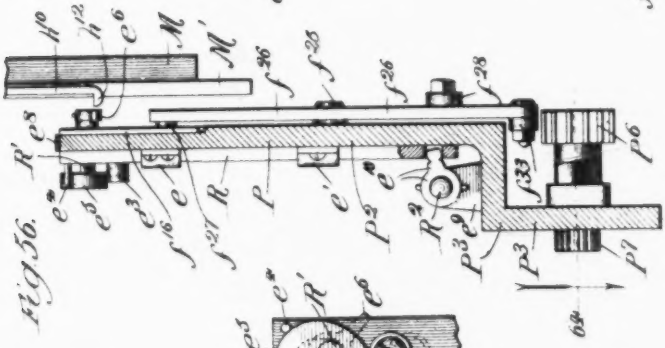


FIG. 156.

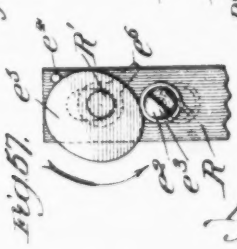


FIG. 157.

Witnesses:
Chas. E. Taylord.
Jule F. Miller

Inventor:
Jacob Uhri,
By Dyrenforth & Dyrenforth
Attys.

1339-1340

No. 608,809. Patented Aug. 9, 1898.

J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

(Application filed Nov. 16, 1895.)

(No Model.) 27 Sheets—Sheet 26.

Fig. 162.

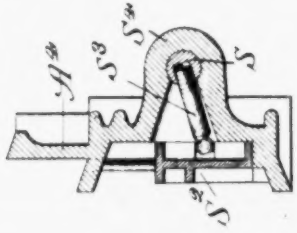


Fig. 166.

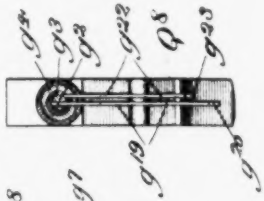


Fig. 161.

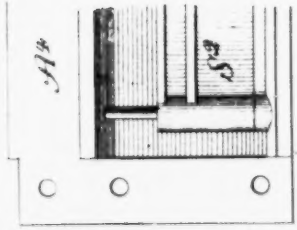


Fig. 165.

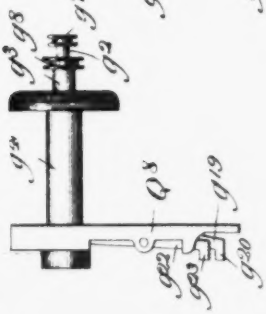


Fig. 163.

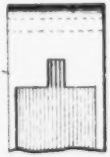


Fig. 160.

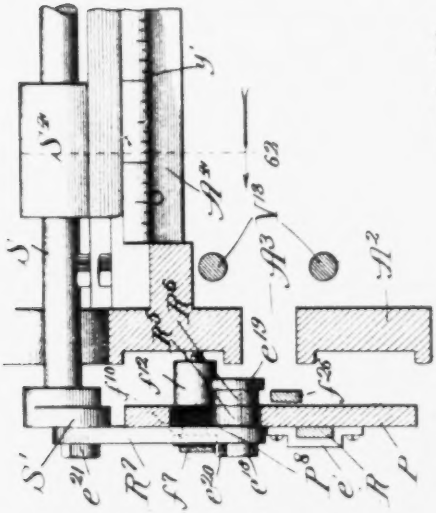
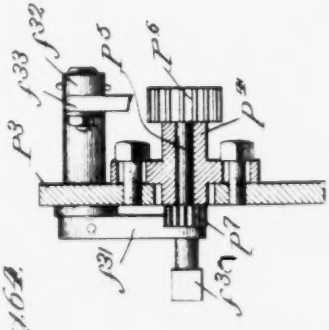


Fig. 164.



Witnesses:
Chas. E. Gaylord.
Lute J. Miller.

Inventor:
Jacob Uhri.
By Dyrenforth & Dyrenforth
Attys.

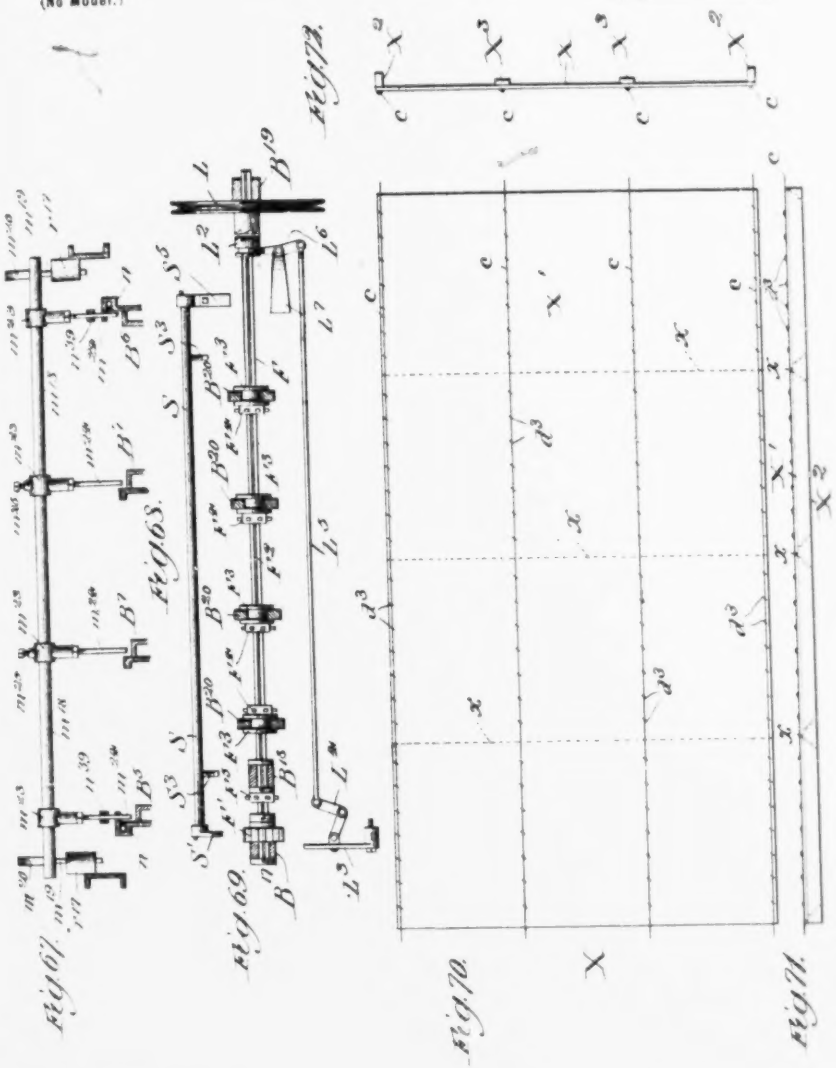
No. 608,809. Patented Aug. 9, 1898.

J. UHRI.

MACHINE FOR MAKING BOX BLANKS.

(Application filed Nov. 16, 1895.)

(No Model.) 27 Sheets—Sheet 27.



Witnesses:
Chas. E. Taylor
Jule J. Allen

Inventor:
Jacob Uhri
By Dyrenforth & Dyrenforth,
Attys.

ends of the blank, so that when the latter is folded to form the four sides of a box it is secured in folded condition by twisting and thus fastening together the ends of the wires. The blank is formed by guiding the sheet with the cleats beneath staple forming and driving devices, which may also serve to guide the strengthening-wires.

The staple-forming and driving machines or tacking devices which I prefer to employ are of the construction shown and described in Letters Patent of the United States No. 483,254, granted to T. L. Knudtson and myself as joint inventors September 27, 1892.

The staple forming and driving devices in themselves form no part of my present invention, and it will suffice to state that they each operate in the upstroke of an operating bar to form from wire fed thereto a staple and in the downstroke of the operating-bar to drive the staple into material fed across the lower end of the device. Each device also operates to guide a strengthening-wire across its discharge end to be straddled by the staples and is provided with mechanism, termed in the patent a "switch," which when turned in one direction causes the operating-bar to actuate a strengthening-wire cutter.

My present invention is in the nature of an improvement upon a machine for making box-blanks for which Letters Patent of the United States No. 518,038 were granted to T. L. Knudtson and myself as joint inventors April 10, 1894, and while the general construction and operation of the present machine are in many respects like those of the said patented machine my present construction performs functions not performed by the other machine and also renders the machine more simple and perfect with respect to certain important details.

Owing to the fact that the present improvements involve changes over the patented construction which have resulted in an almost entirely new machine it has been found necessary to illustrate and it will also be necessary to describe the present machine for the greater part without reference to the patented machine. Those portions of the present construction which involve no material change over the construction shown in the said patents will only be touched upon sufficiently to render their general constructions and

operations clear, though without making it necessary to refer to the patents above mentioned.

Like the patented machine, the present construction has a main frame consisting of sides or cheeks and cross-bars, which latter support the skeleton bed-frame, on which are mounted laterally-adjustable sheet and cleat guides. The drive-shaft extends across the rear upper portion of the frame and carries eccentrics, which at their lower ends connect with a cross-head. The staple forming and driving devices, of which there is one for each cleat-guide, are mounted upon a stationary cross-beam forming a part of the main frame and are laterally adjustable thereon. The operating-bars of the staple forming and driving devices are connected with the cross-head to be actuated thereby. The lower ends of the staple forming and driving devices are in the plane of the upper surface of the sheet as the [fol. 1344] latter passes through the machine, and mounted upon a cross-head, which is also reciprocated by means of eccentrics on the drive-shaft, are clenchers, which as staples are driven bear against the under sides of the cleats to take the impact when the staples are driven. The sheet and cleats are placed in the guides by hand and are engaged by feed-rollers, which advance the material intermittingly through the machine in a manner to cause the material to stop in the downstrokes of the staple-drivers and move along during the upstrokes of the said devices. Thus far the present machine is, generally stated, like the said patented machine. In the operation of both machines the cleats are placed by hand into the guides and the sheet then placed thereon and all then clamped in position to move under the influence of the guide-rollers. As no material can be placed in the machine until the rear end of the material last fed has passed the first pair of feed-rollers, the material being operated upon will naturally move a greater or less distance before the next lot of material—namely, sheet and cleats—can be started.

The improvements in the present machine consist in certain changes which are adapted to render the parts better fitted in certain respects for the performance of their functions and also in certain features of novelty, which are, first, feed-accelerating mechanism which operates when the material is first fed to the machine to advance it with

greater rapidity to the staple-drivers than it is afterward caused to travel intermittingly across the drivers, whereby when material is placed in the machine it may catch up with the material in advance of it; second, in sheet and cleat guides of an improved construction, rendering them readily adjustable to accommodate sheets and cleats of various sizes and which obviate all possibility of the material sticking against the force of the feed-rollers, and, third, in what I term "skipping" mechanism, which operates automatically to prevent the driving of staples at those points along the blank where the step-mitered cuts are to be made.

In the accompanying drawings many of the sectional views and more especially the principal views illustrate no more of the machine than is necessary to show up prominently the parts which it is desired to describe together and in connection with the respective figures. The parts which might be shown in but are left out of the figures referred to are fully illustrated, with their connections, in other figures. This plan avoids unnecessary repetition of details and, it is thought, tends, so many figures being necessary, to prevent confusion.

All the sections referred to in the following description are views in the directions of the arrows at the dotted lines on which the sections are taken.

Referring to the drawings, Figure 1 is a broken view in elevation of the right-hand side of the machine; Figs. 2, 3, 4, and 5, sectional elevations taken, respectively, on lines 2, 3, 4, and 5 of Fig. 6, which latter is a view in elevation of the rear end of the machine; Figs. 7 and 8, plan sections taken, respectively, on lines 7 and 8 of Fig. 6; Fig. 9, a view in elevation of the left-hand side of the machine; Fig. 10, a detail view, partly broken and partly in section, of the outer side of the right-hand supporting-rail of the bed-frame which supports the sheet and cleat guides and the feed-rollers, the section being taken on line 10 of Fig. 8; Fig. 11, a similar view of the inner side of the same rail, the section being taken on line 11 of Fig. 8; Fig. 12, a broken plan section taken on line 12 of Fig. 10; Fig. 13, a broken sectional elevation taken on line 13 of Fig. 12; Fig. 14, an enlarged broken sectional detail of the upper forward end portion of the said side rail, the section being taken

on line 14 of Fig. 35; Fig. 15, a section of the bed-frame, taken on line 15 of Fig. 8 and showing in elevation the outer side of a laterally-adjustable outer guide-rail affording the guide for one of the cleats and for one edge of the sheet; Fig. 16, the inner side of the same rail, the view being an elevation taken from line 16 of Fig. 8 and showing certain shafts and bolts in section; Fig. 17, a broken elevation of the guide-rail shown in Fig. 15 with certain parts removed to expose details of construction which are hidden in Fig. 15; Figs. 18, 19, 20, and 21, enlarged sections taken, respectively, on lines 18, 19, 20, and 21 of Fig. 15, showing details of construction; Fig. 22, an enlarged broken section taken on line 22 of Fig. 8 and showing one or two companion adjusting-screws or screw-shafts for moving the outer guide-rails laterally toward or away from each other on the bed-frame; Fig. 23, a broken and enlarged section taken on line 23 of Fig. 4; Fig. 24, a broken plan section on line 24 of Figs. 4 and 23, illustrating the manner of mounting the four lower rear feed-wheels; Fig. 25, an enlarged broken section taken on line 25 of Figs. 8 and 26, showing one of the outer sheet and cleat guides and one of the adjustable reciprocating staple-clenchers; Fig. 26, an enlarged broken section taken on line 26 of Fig. 25; Fig. 27, an enlarged broken sectional view taken on line 27 of Fig. 7, just inside of the cheek of the main supporting-frame, at the left hand of the machine; Fig. 28, a detached view of one of the details shown in Fig. 27; Fig. 29, an enlarged broken section taken on line 29 of Fig. 27; Figs. 30, 31, and 32, broken sectional detail elevations of feed-regulating mechanism detached from the machine, showing the same in different adjusted positions; Fig. 30ª, a perspective view of a lever forming one of the details in the last preceding figures; Fig. 33, a broken sectional detail view of a part of the mechanism shown in the last-named figures in still another position; Fig. 34, an enlarged broken sectional view taken on line 34 of Fig. 27; [6d. 12453] Fig. 35, a broken and enlarged section taken on line 35 of Fig. 30; Figs. 36, 37, and 38, detail views of the rollers which feed the material—that is to say, the sheet and cleats—through the machine, the positions of the relatively-adjustable parts being governed by the adjustment of the mechanism shown in Figs. 30, 31, and 32; Fig. 39, an en-

larged broken side elevation of the rear end portion of the left-hand side of the machine; Fig. 40, a view nearly the same as Fig. 39, with parts removed to show details which are hidden in Fig. 39, the view being a section taken on line 40 of Fig. 42; Fig. 41, a view nearly the same as Fig. 40, but with still other parts removed, the section being taken on line 41 of Fig. 42; Fig. 42, a broken plan section taken on the irregular line 42 of Fig. 39; Fig. 43, a still further enlarged broken sectional detail of pawl-and-ratchet mechanism shown in Fig. 39, the section being taken on line 43 of Fig. 44; Fig. 44, a broken plan section of the pawl shown in Fig. 43, the section being taken on line 44 of Figs. 39 and 43; Fig. 45, a broken vertical section taken on line 45 of Fig. 44 and showing a part of the said pawl and of a movable segmental guide which when lowered causes the pawl to engage the ratchet-wheel shown in Fig. 43; Fig. 46, a broken and enlarged vertical section taken on line 46 of Fig. 39; Fig. 47, a broken plan section taken on line 47 of Fig. 46; Fig. 48, a detail view in elevation, showing the inner face of a supporting-plate mounted just behind the dial-plate shown in Figs. 39 and 46 and showing more especially friction clutch mechanism, the view being on a reduced scale, taken from line 48 of Fig. 47; Fig. 49, a detail view of mechanism mounted between the dial-plate and the mechanism illustrated in Fig. 48, the view being taken on a reduced scale from line 49 of Fig. 47; Fig. 50, a broken elevation of a portion of the rear end of the left-hand side of the machine, showing the cheek of the main frame and parts carried upon the end of a vertical reciprocating beam which actuates the staple forming and driving devices. The view is taken from line 52 of Fig. 51 in the direction opposite that indicated by the arrow and on a reduced scale. Fig. 51 is a broken vertical section illustrating a portion of the strengthening-wire-severing mechanism, the section being taken on line 51 of Fig. 52; Fig. 52, a view in elevation, taken on line 52 of Fig. 51 and viewed in the direction of the arrow and reduced; Fig. 53, an enlarged elevation of the inner side of a plate detail forming part of the mechanism shown in Fig. 52; Fig. 54, an enlarged section taken on line 54 of Fig. 52; Fig. 55, a broken and enlarged plan section taken on line 55 of Fig. 41; Fig. 56, an enlarged broken section taken on line 56 of Fig. 41; Fig. 57, a broken view of

mechanism shown in Fig. 56, but on an enlarged scale; Fig. 58, a broken and enlarged section taken on line 58 of Figs. 41 and 52; Fig. 59, a view the same as Fig. 58, but showing movable parts in another position; Fig. 60, an enlarged broken plan section taken on line 60 of Fig. 41; Fig. 61, a broken view in elevation of one end portion of a stationary horizontal cross-bar, forming a part of the main frame of the machine, and a movable bar thereon; Fig. 62, a vertical section taken on line 62 of Fig. 60; Fig. 63, a broken view in elevation of one end portion of a horizontally-extending vertical reciprocating bar, forming a detail of the mechanism shown in Figs. 61 and 62, this view showing the reverse side of the said bar; Fig. 64, a plan sectional view taken on line 64 of Fig. 56; Fig. 65, a detail view, in side elevation, of mechanism illustrated in Fig. 47; Fig. 66, a section taken on line 66 of Fig. 65; Fig. 67, a cross-sectional view showing details of stop mechanism for the material to be worked upon, the section being taken on line 67 in Figs. 7 and 15; Fig. 68, a plan view of a rock-shaft which reciprocates the movable plate shown in Fig. 62, said parts having to do with the strengthening-wire severing mechanism; Fig. 69, a section showing a detail plan view of the shaft which operates the forward feed-rollers and wheels and shipping mechanism for throwing the said shaft into and out of engagement with the main driving-shaft of the machine; Fig. 70, a top plan view of a box-blank which the machine is designed to manufacture; Fig. 71, a side elevation of the blank, showing by dotted lines where the cleats are to be cut away by a step-miter machine to which the blank is fed after it leaves the present machine; and Fig. 72, an end elevation of the blank.

A is the stationary frame of the machine, formed with side frames or cheeks A' A^2, which are joined by front cross-bars f and rear cross-bars f'.

B is the stationary bed-frame, which rests upon the upper cross-bars f f' and is secured rigidly in place. The bed-frame is formed with stationary side rails B' B^2, a front cross-bar B^3, a rear cross-bar B^4, and an intermediate bar B^{45}. Resting on the cross-bars B^3 B^4 are laterally-adjustable right-hand and left-hand outer sheet and cleat guides B^5 B^6, respectively, and laterally-adjustable intermediate cleat-guides B^7. Journaled at opposite ends in the guide-

rails B' B² are horizontal right and left hand screw-shafts, (see, for example, Figs. 8 and 22,) one of which, B⁷, is adjacent to the cross-bar B⁴, and the other of which, B⁸, is adjacent to the cross-bar B⁴. Beyond the cheek A' the screw-shafts B⁷ B⁸ carry beveled gears B¹⁰ B¹⁰, which mesh with beveled gears B¹¹ on a shaft B¹², journaled in bearings on the right-hand side of the frame and provided with a hand-wheel B¹³. The screw-shafts pass through threaded bearing-nuts B¹⁴ on the under sides of the guides B⁵ B⁶, and the operation is such that by turning the hand-wheel B¹³ the screw-shafts are turned simultaneously to cause the [fol. 1346] right and left hand guides B⁵ B⁶ to slide laterally on the bars B⁴ B⁴ and approach or recede from each other in parallel planes.

Journaled at opposite ends in the side frames B' B² are shafts C' C², each carrying a pair of what I term "secondary" feed-rollers or feed-wheels C³. The shafts C' C² are journaled at their opposite ends in blocks *s*, set in guide-recesses in the side bars and forming parts of vertically-adjustable yokes B²¹, the said blocks being provided at their under sides with beveled faces, at which they rest upon beveled edge portions or cam-faces on longitudinally-sliding bars *s'*, mounted in the said side frames, as shown in Figs. 10, 11, 12, 13, and 23. The sliding bars *s'* are moved by screws *s²* on the undersides of the side bars and provided with hand-wheels *s³*, whereby when the screws are turned in one direction the bars *s'* are advanced and the yokes at their end blocks *s* are permitted to slide down the cam-surfaces to lower the shafts C' C² simultaneously, and whereby when the screws are turned in the opposite direction the bars *s'* are retracted and raise the yokes B²¹ in their guides to raise the shafts C' C² simultaneously.

On the side bar B⁵ are upward-extending brackets *r r'*, in which is removably fastened toward opposite ends a longitudinally-extending bar or plate *r²*, (see Fig. 3,) and on the side bar B⁶ (see Fig. 5) are upward-extending brackets *r³ r⁴*, corresponding in relative position with the brackets *r r'* and having adjustably secured thereto a longitudinally extending bar or plate *r⁵*. The plates *r² r⁵* afford bearings for the opposite ends of upper forward feed-rollers *r⁶ r⁶ r⁶*, which at their journals on one side pass

through the plate r^3, where they are provided (see Figs. 27, 29, and 35) with sprocket-wheels r^5, all geared together to move in unison by means of a drive-chain r^6. The shaft of the rear feed-roller r^6 passes beyond the bracket r^4, as shown in Figs. 27 and 29, and there carries a pinion r^7, which meshes with a pinion r^{10}, integral with a sprocket-wheel r^{11}, and journaled on a pin or bolt r^{12} on the bracket r^4.

D is the main drive-shaft of the machine, upon which is mounted a driver for the shaft in the form of a pulley D′ and fly-wheel D². The pulley and drive-wheel are loose upon the shaft, and the inner face of the hub of the drive-wheel forms a clutch member adapted to be engaged by a sliding clutch member D³, which is feathered upon the shaft D. The means for moving the sliding clutch member to carry it into or out of engagement with the constantly-rotating clutch member on the fly-wheel consist of a rock-shaft q, journaled in the lower forward edges of the cheeks of the main frame and extending across the lower front portion of the machine. On the right-hand end of the rock-shaft q, (see Figs. 1 and 2,) beyond the cheek A′, is a crank q', pivotally connected to one end of a thrust-bar q^2, which at its opposite end is pivotally connected to a bell-crank lever q^3, fulcrumed at the lower edge of the cheek A′. Pivotally connected with the bell-crank lever q^3 is a vertically-movable rod q^4, which at its upper end connects with the sliding clutch member and operates when it is drawn in the downward direction to produce engagement between the clutch members and when raised to disengage the clutch members. The clutch and mechanism for operating it are substantially the same as in the patent above referred to, and as no claim will be made thereto in the present application it is not thought necessary to give a more detailed description.

On the left-hand end of the rock-shaft q (see Fig. 9) just beyond the cheek A² of the machine is a crank q^5, to which a rod q^6 is pivotally connected at its lower end. At its upper end the rod q^6 connects with a bell-crank lever fulcrumed on the cheek A² and having one of its arms formed into a handle q^7. Movement of the handle q^7 to the left in Fig. 9 operates through the rod q^6, crank q^5, rock-shaft q, crank q' rod q^2, bell-crank q^3, and rod q^4 to move the sliding clutch member D³ into engagement with the fly-wheel and

drive-pulley, whereby the machine is started, and movement of the handle q^7 to the right in Fig. 9 operates with the same rods and levers to disengage the sliding clutch member from the fly-wheel and pulley, and thus causes the machine to stop. On the end of the drive-shaft D, beyond the cheek A^2, is a disk p, (see Figs. 6 and 9,) provided with an eccentric-pin p', provided on its outer end with a crank p^2. Surrounding the pin between the crank and disk is a loose ring or collar p^3, to which is connected a plunger-rod p^4. On the left-hand side of the bed-frame and extending through an opening in the cheek B^2 to the outer side of the latter is a horizontal longitudinally-extending bracket B^{15}, forming a stationary and practically integral part of the bed-frame. (See Figs. 8, 9, 39, and 42.) Extending forward from the bracket B^{15} to be substantially integral therewith and also secured to the bed-frame B is a bracket B^{16}.

E is a rocking disk journaled upon a pin E′ on the outer face of the bracket B^{15}. (See Fig. 42.) Extending through the disk E in the relative positions shown—for example, in Fig. 9—are radial slots p^5 p^6 p^7. The plunger-rod p^4 is pivotally connected at its lower end with a bolt p^8, adjustably fastened in the slot p^5 of the disk E. In the rotation of the drive-shaft D and consequent rotation of the disk p and its eccentric-pin p' the plunger-rod p^4 is reciprocated longitudinally and rocks the disk E on the pin or shaft E′. Extending through and journaled in the bracket B^{16} is a rotary sleeve E^2 on a stationary shaft or pin and carrying on its outer end a ratchet-wheel E^3 and on its inner end a gear-wheel E^4. (See Figs. 9, 39, and 42.) On the inner side of the ratchet-wheel E^3 and pivoted upon the sleeve E^2 to swing thereon is a short arm E^5, carrying a pawl E^6, which normally engages the ratchet-wheel E^3. The arm E^5 [fol. 1347] at its free end is pivotally connected to the end of a thrust-bar E^7, which at its opposite end is pivotally connected to a bolt E^8, adjustably secured in the radial slot p^6 of the disk E. On the outer side of the ratchet E^3 is an arm E^9, pivotally mounted upon the shaft which is surrounded by the sleeve E^2 and carrying at its free end a pawl E^{10}, and pivotally connected with the free end of the arm E^9 is a plunger-rod E^{11}, which at its opposite end is pivotally connected to a bolt E^{12}, adjustably secured in the slot p^7 of the disk E. The pawl E^{10} is normally out of

engagement with the ratchet-wheel E^3 and is only brought into engagement therewith when it is desired to feed at increased speed, as hereinafter described.

F is the feed-shaft or shaft which drives the feed-rollers which move the material to the staple forming and driving devices T. The shaft F is journaled at the side A' of the machine in a hanger B^{17}, forming an integral part of the bracket B^{10}, and a hanger B^{18} on the side rail B^4 (see Figs. 2 and 3), and a bracket B^{19} on the cheek A. (See Figs. 1 and 6.) On the shaft F at the bearing B^{17} is a pinion F^2, which meshes with the gear-wheel E^2, and from the bearing B^{17} nearly to its opposite end of the shaft F is provided with a longitudinal feather-groove F^3. (See Figs. 8 and 69.) On the shaft F are sliding peripherally-grooved collars F^4, each provided with a small sprocket-wheel F^5. The collars and sprocket-wheels are feathered upon the shaft to revolve therewith. The guide-bars B^5 B^6 B^7 are provided on their under sides with rigid downward-extending bifurcated lugs B^{20}, which loosely embrace the collars F^4 in the grooves of the latter, whereby in the lateral adjustment of the guide-bars, as hereinafter described, the collars and pinions are moved along the shaft with the guide-bars. On the shaft F adjacent to the hanger B^{17} is a sprocket-wheel F^6 (see Fig. 27), and carried by a short hanger on the side rail B^4 is an idle sprocket-wheel r^{17}. Passing around the sprocket-wheel F^6 and under the idle sprocket-wheel r^{17} and over the sprocket-wheel r^{16} is a drive-chain r^{15}, which transmits power from the shaft F, through the pinions r^{13} r^{14}, to the upper rear feed-roller r^2, and thence, through the medium of the drive-chain r^3, to the other upper feed-rollers r.

Each cleat-guide B^5, B^6, and B^7 consists, broadly stated, in a side plate u of irregular width, but L-shaped in cross-section throughout the greater part of its extent (see Fig. 19) to produce the vertical side portion u' and horizontal base u^2, and a bar u^3, adjustable with reference to the bar u and L-shaped at opposite end portions. The shape of the bar u^3 in side elevation is plainly shown in Fig. 16. The bar u^3 has a flat top u^4, affording a guide-surface for the under side of a cleat when fed to the machine. The bar u has a longitudinal laterally-projecting flange u^5 at its upper edge, the said flange affording on its under side a guide-surface u^6 for a purpose hereinafter described. Toward opposite end portions of the bar u^3 are downward-extending

pins u^7, which pass through openings in guide-lugs u^8 on the bar u, and sliding at their upper end portions in guides on the outer face of the bar u are vertically-adjustable arms or hangers u^9, having flanges u^{10} at their lower ends, provided with guide-openings for the lower end portions of the pins u^7. The guides for the outer sides of the arms u^9 are afforded by plates u^{11}, secured to the bar u. The plate u^{11} toward the forward end of the machine may be marked with a scale y, as shown toward the left in Fig. 15, and the arm u^9 carries a finger u^{12}, which in the adjustment of the arm u^9 moves along the scale for the purpose hereinafter described.

Mounted against the outer face of the side bar u and held in place by guides are longitudinally and horizontally sliding plates u^{13} u^{14} (see Fig. 17), provided with cam-recesses u^{15}, into which project pins u^{16}, which are fastened to form virtually integral portions of the arms or hangers u^9. The plates u^{13} u^{14} are connected together by a bar u^{17}. The forward edge of the plate u^{13} has an outwardly-extending flange u^{18}, provided with a threaded opening to receive an adjusting-screw u^{19}. The screw u^{19} is mounted in a guide u^{20} on the bar u and is held against longitudinal movement by collars u^{21} on opposite sides of the guide, which do not interfere with the rotation of the screw. The outer end of the screw is squared to receive an operating-crank u^{22}. The pins u^7 are provided with collars u^{23} below the guides u^6, and between the said collars and guides u^{10} are confined stiff supporting-springs u^{24}. Below the guides u^{10} the pins u^7 are threaded and provided with nuts u^{25}. The springs u^{24} press upward against the collars u^{23} and cause the nuts u^{25} to bear against the under sides of the guides u^{10}. Great pressure exerted upon the bars u^1 will press them downward against the resistance of the springs u^{24}, whereby the uppersides u^1 of the bars u^1 form downwardly-yielding guide-surfaces for the cleats fed to the machine. The bar u^5 is raised and lowered equally throughout on the bar u by the turning of the crank u^{22}. When the crank is turned in one direction, it draws the plates u^{13} u^{14} in the direction of the front of the machine, and thereby, bearing at their cam-recesses upon the pins u^{16}, raise the latter, with the arms or hangers u^9, to press the pins u^7 upward and raise the bar u^5. Turning of the crank in the opposite direction lowers the bar u^5 equally throughout by causing the cam-

recesses to press down the pins u^{10} and arms u^{9}. It will be understood that the construction involving the relatively stationary bar u, which forms the guide for one side of a cleat, and the bar u^{1}, which supports the cleat, and the mechanism for raising and lowering the bar u^{1} on the bar u to accommodate cleats of different thicknesses, is common to all the cleat-guides. In the outer cleat and sheet guides [fol. 1348] B^{5} B^{6}, which extend to the rear end of the machine, the bars u^{1} extend only to the clenchers V, and the intermediate guides B^{7} terminate at the clenchers.

At points coincident with the upper feed-rollers r^{6} each of the bars u^{1} is provided with openings through its surface u^{4}, and journaled in bearings in each of the bars u^{1}, below the said openings, are short shafts u^{20}, carrying on one side lower feed-rollers or feed-wheels u^{21}, which project through the said openings in the surface u^{4} and carrying at the opposite sides sprocket-wheels u^{22}. The feed-rollers r^{6} and u^{21} together form what I term "primary" feed-rollers, as distinguished from the secondary feed-rollers C^{4}, before described. Each rearmost shaft u^{20} (see Fig. 29) is somewhat longer than the other shafts u^{20} and carries a second sprocket-wheel u^{23}, which is geared, by means of a drive-chain u^{24}, to the adjacent pinion F^{3} on the drive-shaft F. The three pinions u^{22} on each guide are geared together by a drive-chain u^{25}, as most plainly shown in Fig. 16. Pressing against each drive-chain u^{25} is a spring-actuated chain-tightener u^{26}. Mounted in bearings on the sides of the bars u^{1} are guide-fingers u^{27}, provided at their free ends with rollers u^{28}. Each cleat-guide, as shown in Fig. 8, is provided with three guide-fingers u^{27}, the two forward ones being caused, by means of suitable springs housed in their bearings, to press yieldingly against the adjacent faces of the bars u, while the rear fingers u^{27} are unyielding and adjustable according to the width of the cleats which travel through the machine, all for the purpose hereinafter described. The bars u of the outer cleat-guides B^{5} B^{6} are provided on their inner sides at the flanges u^{3} with longitudinal recesses u^{29}. Fitting loosely in the recesses u^{29} are bars or strips u^{30}, forming guides for the edges of the sheet. At intervals along the strips are retaining-screws u^{31}, which pass through openings in the bars u, as shown in Fig. 20, and at the said screws are confined springs u^{32}. The screws

u^{30} slide freely through the openings in the bars u, and the springs u^{31} tend to press the bars u^{30} to extend flush with the inner faces of the bars u, beyond which they are prevented from projecting by engagement of the heads of the screws with the outer surfaces of the bars u. The strips u^{30} thus form yielding guides for the lateral edges of the sheet and prevent sticking or binding of the sheet at its edges as it is fed with the cleats through the machine. The flanges u^{5} of the guide-bars B⁵ B⁵ at their inner edges portions from the forward feed-wheels u^{27} to the rear ends of the bars overlap the edges of the sheet as the latter is fed through the machine, and the upper faces of the said flanges are cut away, as shown at u^{5} (see Figs. 8, 15, and 16), to clear the upper feed-rollers, and also at u^{33} to clear the stapling devices. In the event that the sheet is warped the overlapping flange u^{5} will hold it flat against the cleats. To facilitate the insertion of a sheet between the yielding edge-guides u^{30}, vertical guide-rollers u^{34} are provided in the forward ends of the guide-bars B⁵ B⁵.

When the material, consisting of the cleats and sheet, is placed in the machine, it is necessary that the forward feed-roller r^{6} be raised and that stops be projected into the paths of the cleats for the sheet and cleats to be placed against to insure their extending evenly with each other at the ends. The forward upper feed-roller r^{6} at its opposite end portions passes through vertically-elongated openings in the plates r^{7} r^{8} and are journaled at their ends in vertically-movable blocks m (see Figs. 14 and 35), housed between the brackets r r^{1} and the adjacent plates r^{7} r^{8}. On the blocks m are guide-pins m^{1}, which pass through vertical guide-openings in the adjacent bracket and carry cross-bars m^{2} at their upper ends, which move in slots r^{13} in the upper ends of the brackets. On the under side of each block m is a downward-projecting guide-pin m^{3}, which enters a guide-opening r^{14} in the side bar, and confined between the side bars and the lower edge of the block is a spring m^{4}. The springs m^{4} tend to raise the blocks m and forward feed-roller r^{6}. Extending longitudinally of the forward feed-roller r^{6}, above the latter, is a rock-shaft m^{5}, journaled at its opposite ends in the brackets r r^{1}. Rigid upon the shaft m^{5} just beyond the bracket r^{1} is a short arm or crank m^{6}, provided on its outer face with a pin m^{7}, having a squared pro-

jecting head. Loosely mounted at one end upon the shaft m^5 just beyond the crank m^6 is an operating-handle m^7 (see Figs. 9, 30, 31, and 32), formed near its head, at which it is pivotally mounted upon the said shaft, with a lug or projection m^8, presenting a shoulder m^{10}. The handle m^7 drops normally to the position shown in Fig. 30. Rigidly secured upon the shaft m^5 where the latter at its opposite ends passes across the sockets r^{15} in the upper ends of the brackets $r\ r^1$ are lugs m^{11}. (See Figs. 14 and 35.) When the rock-shaft m^5 is in the position indicated by the crank m^6 in Fig. 31 the lugs m^{11} are at an angle to the vertical plane. In the turning of the handle m^7 from the position shown by full lines in Fig. 30 to that shown in Fig. 31 the shoulder m^{10} engages the pin m^9 on the crank m^6, whereby further upward turning of the handle to the position shown in Fig. 32 causes the shaft to be rocked in the direction which turns the lugs m^{11} downward to extend in the vertical plane, as shown in Fig. 14. The lugs m^{11} are formed with cam edges which slide upon the upper sides of the bars m^2 and press the latter downward with the pins m' and blocks m against the resistance of the springs m^4 to press the upper forward feed-roller r^6 downward. On the handle m^7 is a lever m^{12}, pivoted at m^{13} and provided on its rear end with a link m^{14}. Pivoted at m^{15} on the lug m^8 is a lever m^{16}, pivotally con- [fol. 1349] nected at one end to the end of the link m^{14}. At its opposite end the lever m^{16} is formed with a socket, as shown in Fig. 30^a, to fit over the squared head of the pin m^9 on the crank m^6.

To rock the shaft m^5 in the direction opposite to that before described, the handle m^7 is raised to the position shown in Fig. 32, and pressure is exerted with the thumb upon the lever m^{12} to raise the latter at its rear end with the link m^{14} and turn the lever m^{16} to cause it at its socketed end to engage the pin m^9. While the parts are thus engaged, the handle m^7 is pressed downward and turns the rock-shaft to turn the lugs or cams m^{11} and permit the upper forward feed-roller r^6 to be raised by the springs m^4. When the pressure of the thumb upon the lever m^{12} is relaxed, the latter is turned to cause the lever m^{16} to disengage the pin m^9 by the action of a spring m^{17}. When the upper forward feed-roller r^6 is in its raised position, as indicated, for example, in Fig. 37, cleats and a sheet may be passed beneath

it to the stops, which will be next described, and when the roller is clamped downward by the pressure of the lugs m^{7}, as shown in Fig. 14, the roller engages and clamps the sheet and cleat against the lower forward feed-wheels n^{27}, as indicated in Fig. 38.

Fastened against the bars r^{2} r^{5} at the brackets r r^{3}, as shown in Figs. 5 and 11, are brackets r^{17}, provided with vertical guide-openings. Adjacent to and parallel with the shaft m^{5} is a rod m^{17}, provided at its opposite ends with downward-extending pins m^{18}, which slide in the guides r^{17}. Secured upon the rod m^{17} at the pins m^{19} are upward and laterally extending fingers m^{20}, bent to form on their under sides convex or cam portions m^{21}. The fingers m^{20} extend over the rock-shaft m^{5}, and on the said shaft at the said fingers are collars carrying lugs m^{22}, having cam edges, as shown. On the cleat-guides B^{5} B^{6} (see Figs. 8, 16, and 15) are brackets n^{30}, having vertical guide-openings, (see Fig. 67,) and coincident therewith are openings through the overhanging portions of the bars n. (See Fig. 67.) On the rod m^{17} are sliding collars m^{23}, carrying dowward-extending rods or stops m^{24} at each cleat-guide B^{5} B^{6} B^{7}. At the guides B^{5} B^{6} the stops m^{24} pass downward through the guide-openings in the brackets n^{30} and bar n, as shown in Fig. 67, whereby when the guides B^{5} B^{6} are slid laterally the stops will move with them by sliding at their collars m^{23} upon the rod m^{17}. When the cleat-guides B^{7} are adjusted by sliding them to the right or left, the stops m^{24} adjacent thereto must be slid independently to adjust them, and when adjusted they may be secured in place upon the rod m^{17} by tightening set-screws m^{25} on the collars m^{23}. When the cleats are first fed to the machine, the stops m^{24} should extend downward close to the guide-surfaces of the cleat-guides B^{5} B^{6} B^{7}, as shown in Fig. 37, so as to present stops against which the ends of the cleats and sheet may abut. To permit the cleats to be fed with the sheet through the machine, the stops must be raised out of the way, as shown in Figs. 36 and 38.

In the turning of the handle m^{7} to rock the shaft m^{5}, whereby the upper forward feed-roller is raised by the action of the springs m^{4}, the cams m^{22} are turned from engagement with the fingers m^{20}, whereby the rod m^{18} and

stops m^{24} drop of their own weight to the position shown in Fig. 37. Thus while the upper forward feed-roller is raised the stops are down. When the handle m^{7} is turned to rock the shaft m^{7} to press down the upper forward feed-roller, the cams m^{22} engage the fingers m^{23} and raise them, the rod m^{15}, and stops m^{24} above the path of the cleats and sheet, as shown in Figs. 36 and 38.

While the material, consisting of the cleats and sheet, is being fed across the staple-drivers, it is necessary that the feed be intermittent to advance the material in the upstroke of the staple-formers and stop the material while staples are being driven. The intermittent feed mechanism, which has been described, is geared to the drive-shaft with reference to the cross-head N, which works the staple forming and driving devices to operate in the manner stated. In operation after the rear end of the material has passed the forward upper feed-roller and is traveling through the machine cleats and a sheet must be placed by hand against the stops m^{24} before they can be started through the machine. Thus if the comparatively slow intermittent feed were relied upon to advance the material initially to the staple-drivers the staple making and driving and strengthening-wire feed mechanisms would operate for a certain period of time while no material is passing across them, which would produce not only a waste of the staples and strengthening-wire, but would also produce a waste of time, all of which it is desirable to obviate. In order that this objection may not be present, I provide accelerating or double-feed mechanism, whereby when the cleats and sheet have been placed in the machine and the material being operated upon by the staple-drivers has passed the third upper feed-roller the three first upper feed-rollers and the three first lower feed-wheels may be run at a speed which will cause the material last fed to catch up with the rear end of the material fed in advance of it as the latter passes from beneath the staple-drivers. This accelerating mechanism will be next described.

As before stated, the pawl E^{10} moves normally out of contact with the ratchet-wheel E^{3}, and the accelerated or double feed consists in causing the pawl E^{10} to engage the ratchet-wheel, whereby the latter and the feed rollers and

wheels run thereby will be turned in the positive direction with each backward rocking of the disk E, as well as with each forward rocking of the latter. The pin m^7, before described, passes through the crank m^6 on the rock-shaft [fol. 1350] m^5, as shown in Fig. 35, and pivotally mounted upon the said pin is a loose collar or guide l for a longitudinally-movable operating-bar l', formed at its end into a handle l^2 and provided on its underside near said handle with a notch l^3. Fulerumed upon the pin m^7 is a lever or catch l^4, having a notch-engaging end l^5 and a handle portion l^6, which parallels the handle l^2. On the rear end of the operating-rod l' and firmly secured thereto is a collar l^7, provided on one side with a laterally-projecting pin l^8. Pivotally connected to the outer end portion of the pin l^8 is a rod l^9. (See Figs 7, 9, 34, 39, 40, and 41.) The rod l^9 is provided on its end portion with a block l^{10}, firmly attached thereto and having a downward-projecting portion which forms a guide for a rod l^{11}. Firmly attached to the end portion of the rod l^{11} is a block l^{12}, having a guide-opening through it where it receives and slides upon the rod l^9. Surrounding the rod l^{11} and confined between the blocks l^{10} l^{12} is a spring l^{13}. The construction involving the blocks l^{10} l^{12} and spring l^{13} is merely to cause the rods l^9 l^{11} to form practically a single yielding-extensible rod. Fulerumed in the bracket B^{15}, Fig. 40, is a bell-crank lever l^{14}, pivotally connected at one end to the end of the rod l^{11} and pivotally connected at its other arm with a lever l^{15}, fulerumed between its ends at l^{16} upon the bracket B^{15}. Extending vertically through the bracket B^{15} are openings for pins l^{17}, which at their upper ends carry a cross-bar l^{18}, pivotally connected to the end of the lever l^{15}, and carrying at their lower ends, below the bracket B^{15}, a block l^{19}, having a segmental edge l^{20}. The pawl E^{10} is pivoted at one end upon a pin l^{21} on the swinging arm E^2, and pivoted between its ends on the pin l^{21} is a block l^{22}, pivotally connected toward one end with the pawl and provided at its opposite end with an upwardly-projecting spring-pin l^{23}. The construction of the block and pin is similar to that shown in Fig. 45. Downward pressure upon the pin l^{23}

causes it to turn the block l^{22} on the pin l^{21} and through the latter to press the pawl yieldingly into engagement with the ratchet-wheel.

When it is desired to have the three forward upper feed-rollers and three forward lower feed-wheels rotate at an accelerated speed, which in practice would always be the case when the upper forward feed-roller is first lowered and the stops m^{13} raised, as indicated in Fig. 38, the latch l^{4} is caused to engage the notch l^{5} in the bar l', whereby in the raising of the handle m^{5} and turning of the arm m^{6}, as before described, the rod l' will be thrust backward to the position shown in Fig. 31. This backward movement of the rod l' causes the rod l^{7} l^{11} to be drawn in the backward direction to turn the bell-crank lever l^{14} and through the latter the lever l^{15} to press down the bar l^{16}, guide-pins l^{17}, and segmental block l^{18}, causing the latter at its edge l^{19} to press down upon the pin l^{21} and turn the pawl E^{3} into engagement with the ratchet-wheel E^{2}, whereby in the oscillation of the disk E, and consequent swinging of the arm E^{7} the pawl E^{3} will turn the ratchet-wheel in the backward oscillation of the disk E, while, as before described, the pawl E^{5} turns the ratchet-wheel in the forward oscillation of the disk E. Thus while when the pawl E^{3} is disengaged from the ratchet-wheel the three upper forward feed-rollers and three sets of lower feed-wheels will turn and advance the material with each forward rocking motion only of the disk E the engagement of the pawl E^{3} with the ratchet-wheel will cause the said feed-rollers and feed-wheels to be actuated and advance the material with each forward and also with each backward rocking of the disk E. When the material thus accelerated catches up with the material in advance of it, the handle m^{5} is lowered and the arm m^{6} swung by engagement of the lever m^{10} with the pin m^{7} in the forward direction. The rod l' is thus moved forward by engagement of the catch l^{4} with the notch l^{5} and through the rod l^{7} l^{11} and levers l^{14} l^{15} raises the segmental block l^{18} out of the path of the pin l^{21}, whereby the pawl E^{3} drops out of engagement with the ratchet-wheel.

Beyond the side bar B^{2} of the bed-frame the shafts C' C'' carry gear-wheels C^{11} C^{12}, and intermediate of the gear-wheels C^{11} C^{12} and meshing with them is a gear-wheel C^{9}.

The gear-wheel C^4 is upon a rotary hollow shaft or sleeve C^5, (See Fig. 42,) journaled upon a stationary pin C^6, which passes through a yoke B^{21}, in which the ends of the rollers C C' are journaled. On the sleeve C^5 is a ratchet-wheel C^7, beyond the outer side of the bracket B^{15}. Loosely surrounding the sleeve C^5 on the inner side of the ratchet-wheel C^7, and thus pivotally mounted upon the said sleeve, is a swinging arm C^8, (see Figs. 9, 39, 42, and 46,) carrying what I term a "primary spring-pawl" C^9, engaging the ratchet wheel. At its free end the arm C^8 is pivotally connected to one end of a rod C^{10}, which at its opposite end is pivotally connected to a bolt C^{11}, fastened in the slot p^6 of the disk E. In each forward oscillation of the disk E the pawl E^7 engages the ratchet-wheel C^7 and turns it to drive the gears C^3 and rotate the shafts of C C' and lower rear feed-wheels C^2, while in each backward oscillation of the disk the pawl wipes across the ratchet-wheel and the feed-wheels remain stationary. These shafts C C' are provided with longitudinal grooves *j*, Fig. 23, and the feed-wheels C^2 have feathers *j'*, Fig. 24, which enter said grooves. On the outer cleat-guides B^5 B^6 (see Figs. 15, 16, and 24) are bifurcated projections or lugs B^{23}, fitting over the shafts C C' and carrying yokes or collars B^{24}, having inner circumferential tongues which fit loosely into annular grooves y^2 in the hubs of the wheels C^2, Figs. 23 and 24. In the lateral adjustment of the guides B^5 B^6, before described, the wheels C^2 are moved longitudinally of the shafts C C', but being feathered upon the shafts they rotate with the latter.

Just above and parallel with the lower feed-wheels [fol. 1351] C^2 are upper feed-rollers H I. (See Fig. 7.) Secured upon the side frames B' B^2 are upward-extending brackets H' on opposite sides of the machine, in the positions indicated in Figs. 7 and 8, the brackets having vertical sleeve portions *k*. Also secured to the side bars B^2, in the positions indicated, are brackets I' I', having upward-extending sleeve portions *i*. (See Figs. 3, 4, 5, 6, 23, and 27.) The sleeves *i* are threaded at their upper inner end portions to receive inner adjusting-sleeves *i'*, provided at their upper ends with hand-wheel portions i^2. Extending through the sleeves *i'* are adjusting-rods i^3, which at their lower ends carry heads or blocks i^4 i^4, in which the oppo-

site ends of the roller I are journaled. Confined in the sleeves i, between the lower ends of the sleeves i' and the heads or blocks i^3, are stiff springs i^4. On the sleeves i are arms i^5, (see Figs. 3, 4, and 27,) i. the upper ends of which is journaled a rock-shaft I^4, Fig. 7, provided at its end adjacent to the check A^5 with a short crank arm i^6. Pivotally secured at their lower ends to the roller I, at the journals of the latter, are upward-extending arms I^5, Fig. 28, pivotally connected at their upper ends with arms i^7, which are rigidly secured to the rock-shaft I^4. Pivotally connected with the free end of the crank arm i^6 is a lever I^6, having a handle portion i^8. The lever I^6 is fulcrumed at i^9 upon the end of a link i^{10}, which at its opposite end is pivoted to a lug i^{11} on the adjacent bracket I^2. The rods i are threaded at their upper ends and there provided with nuts i^{12}. The normal relative position of the roller I with relation to the feed wheels C^3 on the shaft C^4 may be regulated by adjusting the upper sleeves i' on the rods i, and the nuts i^{12} on the rods i. The springs i^4 press the roller I at its opposite ends in the grooves of the feed-wheels C^3, and are limited by the engagement of the heads i^3 with the tops of the inner sleeves i'. To elevate the roller I, however, it is necessary to move it upward from the work material as the latter is being fed, and when it is desired to lift the roller I against the resistance of the springs i^4 this may be done by drawing upward upon the handle i^8 of the lever I^6, which by rocking on its fulcrum i^9 turns the rock-shaft I^4 by means of the crank arm i^6 and turns the arms i^5 to draw the rods i upward and raise the roller I equally at opposite ends. When the lever I^6 is released, the roller will be returned to normal position by the springs i^4.

In the sleeves h (see Figs. 30 to 34) of the brackets H' are inner sleeves h', corresponding in construction with the sleeves i' described, and the said sleeves are provided with hand wheels h^2. (See Fig. 7.) Extending downward through the sleeves h' are rods h^3, provided at their upper ends with adjusting nuts h^4 and at their lower ends carrying heads or blocks h^5, in which the roller H is journaled at its opposite ends. Confined between the lower ends of the inner sleeves h' and the journal blocks h^5 are springs corresponding with the springs i^4 described and which press

the roller in the downward direction. The normal position of the roller H with reference to the feed wheels C^2 on the shaft C is regulated by adjusting the sleeves k' in the sleeves k and adjusting the nuts k^2 on the rods k'. On the sleeves k are arms k^3, in the upper ends of which is journaled a horizontal rock-shaft H^2. Rigidly secured at one end to the end of the rock-shaft H^2, adjacent to the cheek A, is a crank arm k^4, pivotally connected between its ends to a collar k^5, which slides loosely upon the operating-rod l'. On the end of the operating-rod l' and pivoted at one end to the collar l^5 thereon is a link k^6, which at its free end pivotally connects with a lever k^{10}, fulcrumed at its lower end to a lug k^{11} on a cylindrical plug k^{12}, movable in a cylindrical recess in the bracket H'. Extending through a guide-opening in the said plug and bracket H' is a rod k^{13}, one end pivotally connected to the lever k^{10}, between the ends of the latter, and at its opposite end pivotally connected with the lower end of the crank-arm k^4. On the rock-shaft H, near its opposite ends, are crank-arms H^3, and pivotally connected at their upper ends to the crank-arms H^3 and at their lower ends loosely engaging the journals of the roller H are bars H^4. In operation when the sheets and a sheet are initially fed to the staple-forming driving mechanism and the upper forward feed rollers are caused to rotate at accelerated speed, as described, it is also necessary that the roller H be raised slightly, as indicated in Fig. 2, so that the material may pass readily between it and the staple-drivers. Thus the turning of the lever or handle n^7 to thrust the rod l' in the backward direction and accelerate the forward feed rollers and feed-wheels, as described, also raises the roller H by causing the rod l' to thrust the link k^6 in the backward direction to turn the lever k^{10}, draw the pin k^{13}, and swing the crank arm k^4 to rock the shaft H^2, which rocks the crank arms H^3 lift the bars H^4 and raise the roller H against the resistance of its springs. As soon as the material has reached the roller H the handle n^7 is swung downward by the operator to cause the feed rollers c and feed wheels c^2 to turn intermittingly at normal speed, as before described, the lowering of the handle also causing the rod l' to be drawn in the forward direction and move the parts k^6 k^{10} k^{13} k^4 and rock-shaft H^2 in the direction opposite to that described, whereby the rol-

ler H is pressed downward by its springs to clamp the material against the feed-wheels C' on the shaft C.

Journaled on a shaft k^{13}, (see Fig. 41,) mounted in a stationary plate on the machine, hereinafter described, is a rocking disk k^{14}, (see Fig. 52), to which is eccentrically pivoted a link k^{15}, which at its opposite end is pivoted to the pin l' on the rod l'. When the rod l' is drawn forward the [fol. 1352] link k^{15} turns the disk k^{14} almost to a dead-center, as shown in Fig. 52, whereby the rod is held in its forward position with a desired degree of rigidity. When the rod l' is thrust backward to raise the roller H, it causes the link k^{15} to turn the disk k^{14} nearly to the opposite dead-center, whereby the rod will be held in its backward position with sufficient force to overcome pressure of the inclosed springs, which tend to force down the roller H, though not with sufficient force to prevent the rod l' from being drawn forward by means of the lever m^{7}. In case that the roller H is raised against the resistance of the inclosed springs, which press it down, as when a shaving or splinter is upon the material, the rock-shaft H' will be turned and force the pin k^{16} in the backward direction to swing the lever k^{17}. As the rod l', being held by the link k^{15}, as described, will not readily yield, it will act as the fulcrum of the lever k^{17} and the plug k^{18} will be moved, as shown in Fig. 52. This construction prevents interference with the upward yielding of the roller H, which is necessary to prevent the material from becoming clogged at that point.

In the present machine a certain amount of judgment is required on the part of the operator to cause the material when fed to be moved with accelerated speed and catch up with the rear end of the material that is ahead of it by the time the latter passes from beneath the staple-drivers, and it sometimes happens that when the strengthening wires are cut and the machine is stopped, all as hereinafter explained, the material last fed will not have quite reached the staple-drivers. To advance the material to the staple-drivers while the machine is at rest, I provide upon the shaft F', at opposite sides of the pinion F', hangers or arms K, (see Figs. 5, 9, 39, 40, and 41,) which are pivoted upon the shaft to swing freely and between the lower ends of which is fulcrumed between its ends a lever K'. On the rear end of the lever K' is a pivotal link K², to which is pivoted a bar

K^3, provided between its ends with teeth K^4, (see Fig. 41,) adapted to mesh with the teeth of the pinion F'. On opposite sides of the forward end of the bar K^3 are downward-extending plates K^5, which extend on opposite sides of the handle K' and beneath the said handle carry a handle K^6, extending parallel with the handle K'. The parts are normally in the position shown, for example, in Figs. 39, 40, and 41, and when it is desired to turn the pinion F' and shaft F to rotate the upper forward feed-rollers and lower forward feed wheels the handles K' K^6 are grasped to raise the bar K^3 and cause its teeth K^4 to engage the pinion F', after which the handles are drawn in the forward direction to swing with the hangers K and turn the pinion. The handle K^6 is then released to disengage the teeth of the pinion and the parts swung backward, when the operation may be repeated until the material has been moved the desired distance into the machine.

For the purpose more especially of advancing the material into the machine before the latter is initially started I provide the following speed gear mechanism: Loosely journaled upon the shaft F is a belt-pulley L, Figs. 1, 6, 7, and 69, connected by a belt L' with the constantly-rotating drive-pulley D'. The hub of the pulley L is serrated at its inner edge to form a clutch member. Feathered upon the shaft F, adjacent to the pulley L, is a sliding collar L^2, also serrated to form a clutch member. On the outer side of the cheek A' and fulcrumed at its lower end thereon is a swinging lever L^3, (see Fig. 9,) pivotally connected between its ends with a bell-crank lever L^4, fulcrumed on the main frame. The other arm of the bell-crank lever is pivotally connected with a thrust-rod L^5, which extends parallel with the shaft F across the machine and is pivoted at its opposite end to one end of a lever L^6, which at its opposite end is forked to loosely embrace the sliding collar L^2 at a groove in the latter. The lever L^6 is fulcrumed between its ends upon a bracket L^7, (see Fig. 8,) secured to the cheek A'. When it is desired to rotate the upper forward feed-rollers and lower forward feed wheels at comparatively high speed before the machine is started or while it is at rest, the lever L^3 is turned to turn the bell-crank lever L^4 and move the rod L^5 to swing the lever L^6 and move the clutch members into engagement with each other. The pulley L is rotated

constantly by the constantly rotating pulley D', so that the said feed rollers and wheels may be actuated at any time and then released by the turning of the handle L.

While the material is being fed across the staple drivers it is necessary that at certain points or transverse lines, (designated by x in Fig. 70,) where, as before stated, the step mitering machine is to cut away material to permit bending of the blank to form the box, no staples should be driven, for the reason that they would interfere with the operation of the step mitering machine and also with the bending of the blank. The means employed in the present machine for preventing the driving of staples at these points consist in mechanism which moves the material at increased speed and therefore a greater distance across the staple drivers at the up-strokes of the latter when the points x are approached, whereby the said points are skipped in the sense that no staples will be driven there. The mechanism which accomplishes this result will be next described, and following this description will be an explanation of mechanism cooperating therewith to sever the strengthening wires and then stop the machine.

On the vertically reciprocating bar or cross-head N, which is operated by eccentrics N' on the drive-shaft D to actuate all the staple drivers T, is a vertical bar or carrier M, (see Figs. 6, 39, 40, 41, and 46,) which reciprocates in a slide [illegible] formed by a vertical slot A' in the cheek A of the machine frame. On the carrier is a plate M', having its upper and lower ends shaped, respectively, to afford cams for purposes shown most distinctly in Fig. 50. Above the cam-plate M' and firmly secured to the carrier M is an outwardly and downwardly projecting finger M''. Near the upper end of the cam-plate M' and carried thereby is a stop M'', (see Fig. 46,) which consists of a rock-shaft or pin *k*, journaled in a bearing-plate or bracket *k'*, fastened to the plate M', and carrying at one side of said bearing, at a point midway between the ends of the plate, a head *k''* (see Fig. 46,) provided with the three stop-projections *k k k*. The stop-projection *k* rests against a spring-stud *k'''*, which tends to press the stop *k* in the outer direction. And the stop *k* against the face of the plate M' forward pressure against the stop *k* would tend to turn the head *k''* on its axis against the resistance of the spring-stud *k'''*. The spring of the spring-stud is made very

stiff, so that while in the operation the impact of the stop h' against the parts hereinafter described will not turn the head h^2 the spring-stud h^5 renders the head yielding to a slight degree in case that, through want of perfect adjustment, the plunge of the carrier M, as hereinafter described, should be excessive. Also upon the cam-plate M', in the position shown, is a rigid forward-projecting pin l', (see Figs. 50 and 51,) and directly below the said pin is a laterally-swinging finger l^2, pivoted at l^3 and having an outwardly-projecting toe l^4. At the side of the pin l' and rigid upon the plate M' is a wedge-shaped cam-block l^5. (Shown most distinctly in Fig. 51.)

Bolted upon the chuck A in the position shown is a plate P, provided on its rear face with spacing projections or lugs P'. (See Figs. 49 and 52.) The plate P has the plain upper portion P^2 and lower portion P^3, which is L-shaped in vertical cross-section, as indicated for example, in Figs. 56, 58, and 59. Journaled in a bearing P^4, which is adjustably secured to the part P^3 of the plate P, is a short shaft P^5, (see Figs. 46 and 61,) provided at one end, on the inner side of the bearing, with a pinion P^6, which meshes with the gear-wheel C, and provided at its opposite end, at the forward face of the part P^3, with a pinion P^7.

Fastened against the forward face of the part P^3 of the plate P is a bearing-case or housing Q, consisting of a back plate Q' and front plate Q^2. (See Figs. 46 and 47.) The front plate Q^2 is provided on its rear face with a marginal flange Q^3, against which the back plate is secured to afford a chamber Q^4. On the front face of the plate Q^2 is a re-cess Q^5, provided with a peripheral flange Q^6, which is provided with a groove Q^7, V-shaped in cross-section, as shown, for example, in Figs. 46 and 47. Journaled upon a pin or screw a^2 in the lower part of the bearing Q is a pinion a', (see Figs. 48 and 49,) which meshes with the pinion P^7, to be driven therefrom, (as shown in Fig. 49.) Extending through the bearing, at the center of the circle described by the groove Q^7, is a pin or shaft q', surrounded by a sleeve q^2, which sleeve is surrounded by a sleeve q^3, which carries upon the front end a large gear-wheel q^4 in the chamber Q^4. The chamber Q^4 is open at its lower end, and at the said opening the gear-wheel q^4 meshes with the gear-wheel a'. (See Figs. 46 and 49.) The pin

q^5 slides longitudinally in the sleeve q^4 and is provided on its inner end with a grooved collar q^7. The sleeve q^5 in turn slides longitudinally on the pin q^6 and in the sleeve q^4 and at its inner end carries a grooved collar q^8. The sleeve q^4 slides loosely in the hub q^2 of the wheel q^3 and is provided on its inner end with a cup-shaped friction clutch member q^9. The hub q^2 of the wheel q^3 is shaped to form at its inner face a clutch member to be engaged by the clutch member q^9 in the sliding of the sleeve q^4, as hereinafter described. Firmly secured upon the sleeve q^4 as shown in Figs. 65 and 66, is an arm Q^2. Fastened against the lower part of the plate Q^2 is a U-shaped bracket Q^3, (see Figs. 39 and 46,) carrying a disk Q^{30}, forming a housing for the arm Q^2. Secured at one end to the hub portion of the arm Q^2 and at its opposite end to a stud q^{10} on the disk Q^{30} is a coiled spring q^{11}, which tends normally to cause the arm Q^2 to bear against a stop q^{12} on the plate Q^2. At intervals around the disk Q^{30} are adjustable studs or posts Q^{31}, Q^{32}, Q^{33}, and Q^{34}, comprising cylinder portions q^{13}, having laterally projecting arms q^{14}. Extending through the cylinder portions q^{13} are pins q^{15}, at their inner ends formed with T heads q^{16} to fit the T groove Q^4 and threaded at their outer ends to receive thumb-nuts q^{17}. The arms q^{14} extend parallel with and adjacent to the inner surface of the disk Q^{30}, and on the cylinder portions are pointers q^{18}, which extend over the edge portion of the disk Q^{30}. By loosening the thumb-nuts q^{17} the studs or posts may be slid around the T-groove Q^4 to any desired position and may then be fastened firmly in place in such position by tightening the thumb-nuts q^{17}. Around the circumferential edge portion of the disk Q^{30} is a scale, as indicated, for example, in Fig. 39, all for a purpose hereinafter described.

Pivotally mounted between its ends on the arm Q^2 is a tripping finger q^{19}, provided at its outer end with a forward-projecting lug or toe q^{20}, (see Fig. 65,) and at its inner end portion the said finger passes loosely through recesses in the hub of the arm Q^2 and in the sleeves q^4 q^5 into pivotal engagement with the pin q^6, the pin q^6 being provided with a short slot q^{21} (see Figs. 46 and 47) to receive the end of the finger, which latter is rounded, as indicated in Fig. 46. Parallel with the finger q^{19} and somewhat shorter than the latter is a tripping finger q^{22}, also pivoted between its ends

on the arm Q^3 and passing through recesses in the hub of [fol. 1354] the arm Q^3 and in the sleeve q^4 into pivotal engagement with the sleeve q^4. At its outer end the finger q^{23} carries a forward-projecting lug or toe q^{24}.

On the rear side of the plate Q' (see Figs. 47 and 48) are bearing lugs f f, between which is pivoted a swinging arm f'. Also fastened upon the rear face of the plate Q are guide projections f^2 f^2 for the opposite sides of the arm f'. The free end portion of the arm f' is bifurcated and provided in its ends with antifriction-rollers f^3 f^3, which ride upon the rear face of the sliding friction clutch member q^9. On the side of the arm f' is a projection forming a cam-block f^4. Confined between the clutch members q^7 q^9 is a spring q^{11}, which tends normally to press the said clutch members out of engagement. Fulcrumed at f^5 on the front side of the plate P (see Fig. 41) is a lever f^6, which has a long arm extending past the side of the housing Q. Pivotally mounted upon the end of the short arm of the lever f^6 to swing laterally thereon is a downward-extending finger f^7, the lower portion of which forms a cam f^8. (See Fig. 58.) Above the short arm of the lever f^6 on the plate P is a stop f^9, which limits the rise of the short arm of the lever. At the side of the finger f^7 opposite the cam f^8 is a yielding stop f^{10}, (see Fig. 47,) which is held in normal position by a stiff spring f^{11}, confined between the shoulder on the stop or pin f^{12} and the inner end of a screw cup or thimble f^{13}, fastened in the plate P.

When the short arm of the lever f^6 is in the raised position shown, for example, in Fig. 41, the upper end of the finger f^7 is in the path of the finger M^{11} on the vertically reciprocating carrier M. When the machine is started, the first downward plunge of the carrier causes the finger M^{11} to strike the upper end of the finger f^7 and drive the latter downward, so that the cam f^8 slides between the spring-stop f^{10} on the one side and the cam-block f^4 on the opposite side, whereby the arm f' is swung to press the clutch member q^9 into engagement with the clutch member q^7 and cause the sleeve q^4 to revolve with the wheel q^6 and swing the arm Q^3. It will be remembered that the wheel q^6 meshes with the pinion q^7, which in turn is engaged by the pinion P^9 on the shaft P^7, which latter carries the pinion P^{10}, meshing with the gear-wheel C^{11} on the sleeve C^{10}, carrying the

ratchet-wheel C^{7}. Thus the intermittent movement of the ratchet-wheel C^{7} is conveyed to the wheel g^{6} and through the latter when its hub or clutch member is engaged by the clutch member g^{7} to the sleeve g^{8}, carrying the arm Q^{5}, causing the latter to be turned intermittingly against the resistance of the spring g^{11}.

The posts Q^{11} Q^{12} Q^{13} Q^{14} in practice are adjusted with reference to the scale on the disk, so that the arm Q^{5} will pass the post Q^{11} when the first skip is to be made, the post Q^{12} when the second skip is to be made, the post Q^{13} when the third skip is to be made, and the post Q^{14} when the cut-off mechanism is to be actuated and the machine stopped. On each of the fingers g^{14}, carried by the posts Q^{11}, Q^{12}, Q^{13}, and Q^{14}, is a cam g^{15}, the said cams on the fingers of the posts Q^{11}, Q^{12}, and Q^{13} being in the path of the lug or toe g^{16} on the finger g^{17} and the cam g^{15} on the post Q^{14} being in the path of the lug g^{18} on the finger g^{19}. In the rotation of the arm Q^{5} the lug or toe g^{16} wipes across the cams g^{15}—first that on the post Q^{11}, then that on the post Q^{12}, and then that on the post Q^{13}—and as it engages a cam the finger g^{17} is swung on its pivot to move the pin g^{4} longitudinally outward or to the left in Fig. 46.

On the rear face of the plate Q^{7} is a stud or bracket f^{13}, Figs. 46 and 48, and pivoted between their ends upon the stud f^{13} are swinging fingers f^{14} f^{15}, which at their lower ends are bifurcated to engage, respectively, the collar g^{5} on the pin g^{4} and the collar g^{9} on the sleeve g^{8}. The inner face of the part P^{3} of the plate P is recessed in its upper end portion to receive, retain, and guide a vertically sliding plate f^{16}. (Shown in detail in Fig. 53, and see Figs. 46, 52, and 55.) In the said plate are a longitudinal opening f^{17}, an inclined slot or cam-opening f^{18}, and an opening for a push-pin f^{19}. Below the pin f^{19} on the plate f^{16} is a cam-block f^{20}, provided with a shoulder f^{21}, forming a stop or catch. Fastened against the part P^{3} of the plate P is a leaf-spring f^{22}, (see Figs. 46 and 52,) provided on one side with a cam projection f^{23}, having a shoulder f^{24}. The cam projection f^{23} is in the path of the cam f^{25} on the plate f^{16}, and the shoulder f^{24} on the spring f^{22} is adapted to engage the shoulder f^{21} on the plate f^{16}. (See Fig. 46.) Pivoted at f^{26} (see Fig. 52) on the rear face of the part P^{2} of the Plate P is a lever f^{27}, at its upper end carrying a laterally-

extending antifriction roller f^{37}, (see Fig. 54,) which extends into the cam-opening f^{38} on the plate f^{39}. Between the pivot f^{36} and the lower end of the lever f^{35}, and upon the latter is pivotally connected a pin f^{40}, which passes through a guide-opening in the adjacent spacing-lug P'. (See Fig. 52.) Surrounding the pin f^{40} and confined between the said spacing-lug and a cross pin or shoulder on the pin f^{40} is a stiff spring f^{41}, which tends normally to swing the lower arm of the lever f^{35} in the direction to the left in Fig. 52. Journaled in the part P' of the plate P (see Figs. 46, 52, and 58) is a short shaft f^{42}, carrying on one side of the plate a crank f^{43} and at its opposite end a crank f^{44}. Pivotally connected with the lower end of the lever f^{35} is a link f^{45}, which at its opposite end is pivotally connected with the crank f^{44}.

On the outer side of the bracket B^{25} (see Fig. 40) is a box B^{27}, which forms an outer bearing for the pin or shaft C^{26} and is provided at opposite sides of said pin or shaft with vertical guide-openings (see Fig. 45) for pins f^{46}, which above said box carry a cross-bar f^{47}, pivotally connected with the free end of the crank f^{43}. Below the box B^{27} the [fol. 1355] pins f^{46} carry a segmental plate f^{48}. Pivotally connected to the crank p^2 on the end of the drive-shaft D is a plunger-rod f^{49}, (see Figs. 6 and 9,) which at its lower end is pivotally and adjustably connected with a bell-crank lever f^{50}, fulcrumed upon the sleeve C'. On the opposite end of the bell-crank lever f^{50} is a laterally-projecting pin f^{51}, (see Figs. 43 and 44,) upon which is pivotally mounted what I term a "secondary pawl" f^{40}. Pivotally mounted on the end of the pin f^{51} is a lever f^{52}, at one end connected through the medium of a pin f^{42} with the dog or pawl f^{40} and on the opposite side of its pivot carrying a spring stop projection f^{53}, which is directly below the segmental edge of the plate f^{48}, as shown also in Fig. 40. In the rotation of the drive-shaft D the rod f^{49} is plunged up and down to swing the bell-crank lever and pawl along the ratchet edge of the wheel C^{27}; but the pawl is normally out of engagement with the ratchet-wheel, as shown in Figs. 9 and 43.

When the arm Q^8 in its rotation reaches the first post Q^{11}, the finger f^{19} at its lug g^{20} wipes across the respective cam g^{21} carried by the said post, and in doing so the finger

g^{10} is swung on its pivot in the direction of moving the pin g in the outward direction, which is the direction to the left in Fig. 46, whereby the lever f^{10} is caused to move the pin f^{9} against the resistance of the spring f^{11} and swing the latter at its stop f^{12} out of engagement with the shoulder f^{13} on the plate f^{8}. The plate f^{8} being thus released is raised in its guide by the pressure of the lever f^{6}, Fig. 52, in the cam-opening f^{7}, the said pressure being due to the spring f^{14}. This turning of the lever f^{6} draws upon the link f^{5} and swings the crank f^{4} and rocks the rock-shaft f^{3} to swing down the crank f^{2} (see Fig. 40) and depress the segmental plate f, whereby it presses downward upon the spring-pin f^{1} and swings the pawl f' into engagement with the ratchet-wheel C'. The ratchet-wheel, as before stated, is moved with each reciprocation of the disk E, and the engagement of the pawl f' with the ratchet-wheel C' turns the latter while the disk E is rocking in the direction which causes the pawl C^{6} to slide over the ratchet-wheel C'. The plunger-bar f at its lower end is adjustably secured in a longitudinal slot in the bell-crank lever f^{6}, as shown, for example, in Fig. 9, so that the distance of turning of the ratchet-wheel with each operation may be regulated. It will be remembered that the turning of the ratchet-wheel C' rotates the lower rear feed-wheels C, so that each time the ratchet-wheel is actuated by engagement with it of the pawl f' the material will be fed at increased speed across the staple-drivers T.

On the outer side of the part P' of the plate P are guides c c', Figs. 41 and 56, for a vertically disposed and longitudinally-sliding bar R. On the bar, directly above the guide c, is a pin or screw c^{2}, carrying a roller c^{3}. (See Fig. 54.) At the top of the bar R in the position shown is an outwardly-projecting pin c^{4}. Passing through and journaled in the part P' of the plate P is a rock-shaft R', which also passes through an elongated slot in the bar R and the elongated slot f^{15} in the plate f^{8}, Figs. 53 and 54, whereby the shaft will not interfere with the sliding of either said bar or plate. The rock-shaft R' at its outer end carries a cam c^{5}, and at its opposite end it carries a crank-arm c^{6}. (See Figs. 56 and 57.) The shaft R' is somewhat longer than the parts through which it passes and in which it has its bearings and is capable of sliding

longitudinally in its bearings. As shown in Figs. 51 and 54, the rock-shaft R^7 is in its normal or outward position, and when moved longitudinally in the inner direction the crank c^{37} thereon is moved into the path of the toe h^{12}, carried by the finger h^{11}, which, as before explained, is pivotally mounted upon the reciprocating cam-plate M^4. The cam c^{36} is normally in contact with the roller c^{35} on the bar R, and adjacent to the outer face of the cam is the end of the finger f^{11}, before described. Extending through an opening in the top of the part P^7 of the plate P is a pin c^{38}, (see Fig. 54,) and pressing downward upon the pin is a finger-spring c^{39}, (see Fig. 52,) which causes the pin to press yieldingly upon the rock-shaft R^7, and thus produce a frictional resistance against the turning and sliding of the latter. On the upper face of the horizontal portion of the part P^7 of the plate P are bearing-lugs c^{40} c^{41}, see Figs. 41, 56, 58, and 59) for a horizontal rock-shaft R^8. On one end of the rock-shaft, beyond one of the bearing-lugs c^{40}, is a crank-arm c^{42}, (see Fig. 56,) which enters a socket in the lower end portion of the bar R and is there in pivotal contact or connection with the said bar. Fastened upon the rock-shaft R^8 between its bearings, is a yoke R^9, provided in its ends with inwardly-projecting pins c^{43}. In the part P^7 of the plate P is an opening P^8 of the shape shown, for example, in Figs. 41 and 52. Extending across the lower part of the opening on the forward side of the plate and rigidly secured to the latter is a cross-plate P^9. The cross-plate midway between its ends is provided with a bearing-opening for a longitudinally-movable rock-shaft R^4. On the outer end of the shaft R^4 is a collar c^{44}, (see Fig. 41,) provided with a peripheral groove c^{45}, (see Figs. 58 and 59,) into which the pins c^{43} on the yoke R^9 project. Surrounding the rock-shaft R^4 and confined in a socket in the plate P^9, to bear at opposite ends, respectively, against the said plate and the collar c^{44}, is a spring c^{46}, which tends normally to press the shaft R^4 in the outer direction to the position shown in Fig. 58. Loosely mounted upon the shaft R^4 in the opening P^8 is an arm R^{10}, (see Fig. 59,) and fixed upon the inner end of the shaft R^4 is an arm R^{11}. (See Fig. 52.) Screwed into the free end portion of the arm R^{10} is a hollow stud c^{47}, presenting an annular socket or bearing-surface c^{48} (see Fig. 58) and an outer flange c^{49}. Extend-

(fol. 1356) ing through the hollow stud c^{11} on pin c^{9}, which is fixed to the arm R' and slides loosely in the open-ing through the stud. Thus in the rocking of the shaft R', as hereinafter described, the arm R' will be rocked with the shaft, and owing to its pin-connection c^{9} with the arm R the latter will also be rocked, and when the shaft R' is slid longitudinally toward it slides the arm R' in the same direction, the pin c^{9} holding the arm R when thus separated so that they will rock together. The end of the pin c^{9} beyond the arm R' forms a bearing for a wheel c^{12}, which is confined upon the pin, as shown in Fig. 58. Pivotally mounted at the end upon the bearing surface c^{13} of the lug c^{10} (see Fig. 58) is a link R, provided, in the position shown, with an inwardly-projecting pin r^{3}, (see Figs. 41 and 60,) which projects across the lateral edge of the downward-extending cam-finger r, before described.

A rock-shaft S, Fig. 1, extends across the machine parallel with the staple-former beam V, upon which the staple-forming and driving machines are mounted. A detail view of the rock-shaft S is shown in Fig. 68. On the end of the shaft S is a crank S^{5}, which at its free end is pivotally connected to the link R by means of a pin r^{4}. (See Fig. 41.) Pivoted upon a pin extending from the inner side of the part P' of the plate P is a bearing-lug P^{6}, (see Fig. 52,) and fulcrumed between its ends upon the said bearing-lug is a swinging lever R'' of the shape shown, for example, in Figs. 41 and 52. At its upper end the lever R'' carries an anti-friction roller r^{5}, and at its lower end it is pivotally connected to the before-mentioned pin r^{4} on the end of the link R. Housed in the beam V' is the horizontally-extending and vertically-sliding bar S^{6}, (see Figs. 61 and 62,) which operates the strengthening-wire severing mechanism of the staple forming and driving machines, as hereinafter more particularly described. Toward opposite ends the shaft S is provided with fingers S^{7}, (shown in Figs. 62 and 68,) the ends of which are formed into balls and enter sockets in the bar S^{6}. The shaft S is journaled in bearings S^{8} on the beam A', and at its end opposite the crank S^{5} it carries a crank S^{9}. (See Figs. 68, 1, 2, 6, and 7.) On the rod q^{4}, Fig. 2, which moves the sliding clutch-member on the shaft D, is a laterally-projecting bearing q^{5}, having a downwardly-projecting spring-pin q^{6}, which is just above the path of the crank S^{9} of the rock-shaft S.

In operation, when the arm Q' is moved around to the position where the toe q^{10} on the finger q^9 engages the cam q^{11} on the post Q^3, the finger q^9 is swung upon its pivot by said engagement to move the sleeve q^8 in the outward direction and swing the finger f against the outer face of the cam f' and push the shaft R' in the inward direction, whereby the crank arm r^2 extends in the path of the toe h^2 of the swinging finger h, which, as before explained, reciprocates with the carrier M. In the next upward plunge of the carrier M the toe h^2 engages the under side of the crank arm r^2 and turns it to rock the shaft R' and turn the cam r^3, whereby the latter presses down the antifriction-roller r^4 and moves the bar R longitudinally downward. This movement of the bar R, owing to its connection with the crank r^5 on the rock-shaft R^2, rocks the latter and swings the yoke R^3 to move the shaft R^4 in the inward direction (to the right in Fig. 5x) and presses the arm R^5, with the roller r^6, into the path of the cam plate M'. Thus in the next downward plunge of the cam plate M' its cam edge k', Fig. 40, strikes the roller r^6 and turns the arms R^5 R^4 in the direction which forces the link R' in the direction to the left in Fig. 41, whereby the crank S' is rocked to actuate the strengthening-wire cutter mechanism, and whereby the crank S² on the opposite end of the rock-shaft S engages the pin q^7 and raises the rod q^4 to disengage the clutch members on the drive shaft and stop the machine. The movement to the left in Fig. 41 of the link R' also turns the lever R^6 on its pivot at P^6, whereby the antifriction-roller r^7, carried by the lever, (see Fig. 52,) extends in the path of the cam surface k of the cam plate M'. Thus in the next upward stroke of the cam plate M', which is the last movement before the machine stops, the cam surface k of the cam plate engages the antifriction roller r^7 and returns the lever R^6 and through it the link R' and the arms R^4 R^5 to their initial positions.

At the same time that the link R' is moved to the left in Fig. 41 the pin r^8 thereon engages the downwardly-extending cam finger f^2 and swings it from between the cam f' and the stationary stop f^3, (in which position it has held the clutch members q^5 q^6 in engagement, as before described,)

thereby permitting the spring g^{11} to separate the clutch members g^{7} g^{8}, as shown in Fig. 46, and permit the spring g^{10} to swing the arm Q to its initial position against the stop g^{9}, as shown in Fig. 40. After the finger b^{7} has acted upon the crank arm c^{7} in the manner described to actuate the strengthening-wire-severing mechanism the pin b^{8} on the cam-plate M' in the next downward plunge of the carrier strikes the crank arm c^{7} and turns it in the downward direction, whereby the shaft R' is rocked to turn the cam c^{6}, so that the bar R will be raised to its initial position by swinging of the rock-shaft R', effected by the recoil of the spring c^{10}. Directly after the pin b^{8} has turned the crank-arm c^{7} the end of the shaft R' engaged by the cam b^{10} (on the plate M') and pushed in the direction (to the left in Fig. 56) which carries the crank-arm c^{7} both out of the path of the toe b^{9} on the finger b^{7} and and to the position shown in Fig. 56. When the swinging cam-finger f^{7} is moved by the pin c^{13} from between the stop f^{10} and cam f^{9}, as described, the weight of the long arm of the lever f^{7} will swing its short arm upward against the stop f^{8} and thus raise the [fol. 1357] finger f^{7} to its initial position, ready to be engaged by the finger M^{7} on the carrier M in its next downward plunge, as before described.

In Figs. 25 and 26 I show the clenchers I prefer to employ and which are of special and improved construction to render them readily adjustable and strong. Each clencher comprises a block or shell V^{4}, fastened to the respectively adjacent cleat-guide bar B^{3}, B^{4}, or B^{5}. Extending vertically through the shell or block V^{4} is a guide-opening V^{5} for the clencher-stem V^{6}. The clencher-stem is surmounted by a clencher-head or anvil V^{8}. The lower part of the guide-opening V^{5} is enlarged, as indicated in Fig. 26, and crossing the same is a chamber just large enough to receive an adjusting-wheel V^{9}. Below the adjusting-wheel V^{9} and extending through the latter is a base or socket-piece V^{10}, having a keyway at which the wheel V^{9} is feathered thereon, as indicated at V^{11}, to cause the wheel and socket-piece V^{10} to turn together. The socket-piece V^{10} is capable of moving longitudinally through the wheel V^{9}, and its socket portion is threaded to receive the lower threaded end portion of the stem V^{6}. On the stem V^{6} is a pin V^{12}, which

passes through an elongated slot V^{7} in the side of the shell V^{2}, and is there provided with a pointer V^{10}, which moves along a scale V^{11} on the shell at the side of the said slot. On the drive-shaft D are eccentrics V^{12}, which are connected by means of suitable plunger-rods V^{13} with a horizontal cross-head V^{4}, extending parallel with the cross-head N, which actuates the staple forming and driving devices. The bases or socket-pieces V^{5} at their lower ends rest firmly upon the upper edge of the cross-head V^{4}, and confined between the wheels V^{6} and annular shoulders on the socket-pieces V^{5} are springs V^{14}. In the circumferential face of each wheel V^{6} is a series of holes V^{15}, into which a lever may be inserted to turn the wheel, and confined in the shell V^{2}, in the manner shown in Fig. 26, is a spring pin or catch V^{16}, adapted to enter and engage the holes V^{15}. The wheels V^{6} fit snugly in the recesses in which they are housed, and in the upward movement of the cross-head V^{4} the socket-pieces are raised against the resistance of the springs V^{14} to raise the stems V^{8} and heads V^{9}. In each downward movement of the cross-head the socket-pieces V^{5}, with the stems V^{8} and heads V^{9}, are moved downward with the cross-head by the springs V^{14}. The stems V^{8} may be raised and lowered in the socket-pieces V^{5} as desired for the purpose of adjustment by withdrawing the spring-pins V^{16} and turning the wheels V^{6}. The scale V^{11} will aid in making the desired adjustment. In the operation of the staple-drivers the impacts upon the clenchers are conveyed through the stems and socket-pieces to the cross-head V^{4}, and there is no strain upon the shells V^{2} or the cleat-guides on which they are mounted.

Many of the details are constructed as described for the purpose of rendering them adjustable, whereby box-blanks X, Fig. 70, of different dimensions may be manufactured by the same machine. The thin wooden sheets or strips X', which are to form the outer sides of the ultimate box, are provided of the proper width and length, a sheet for a box being preferably all in one piece and about one-eighth of an inch in thickness. The cleats are of the same length as the sheet and may be, say, one-half an inch thick and three-fourths of an inch wide. In practice the sheets and cleats may be provided of a length a trifle greater

that is required for the box to allow for shrinkage in drying before being operated upon by the present machine. As shown in Fig. 72, the outer cleats X are upon edge, while the intermediate cleats X extend flatwise along the sheet. Presuming, for example, that the ultimate box is to be one and one-half feet square by three feet long and employ cleats one-half an inch thick by three-fourths of an inch wide, the sheets provided would be just three feet wide and not less than six feet long, and the cleats of approximately the same length.

The adjustment of the machine for a box of the dimensions named would be effected as follows: On the plate *a* of each guide B, B, and B (see, for example, Fig. 19) is a scale *a*, with which the upper end of the arbor *a* registers to indicate the height of the upper or guide surface *a* of the bar *a* with reference to the front guide *a* (see Figs. 18 and 19) for the edge of the sheet. A handle *a*, Fig. 17, is applied to the screw *a*, and the adjustment of the bar *a* is effected as before described. The bars *a* of the outer cleat guides B B will be raised or lowered, as required, to cause their guide surfaces *a* to extend in a plane three-fourths of an inch below the sheet guides *a* to accommodate the cleats X, and the bars *a* of the intermediate guides B will be adjusted in the same manner to extend at their surfaces *a* one-half an inch below the upper edges of the bars *a* to accommodate the cleats X. Thus the distance between the upper feed rollers *e* and lower feed wheels *e* will be just sufficient to cause them to firmly grip the sheet and cleats between them, as indicated, for example, in Fig. 36. The second and third feed rollers *e* occupy fixed positions, and the rollers H I are normally in the same plane as the said rollers *e*. The feed rollers *e* are then adjusted by means of the hand wheels *e* and mechanism actuated thereby, (see Figs. 10 to 13,) all as before described, to extend one-eighth of an inch below the rollers I H to grip the sheet. By means of the hand wheel B (see Fig. 1, for example) the screw shafts B B (see Fig. 8) are turned coincidently, as before described, to cause the outer cleat guides B B to approach or recede from each other until the guides *a* for the edges of the sheet are just three feet apart.

[fol. 1358] As shown most clearly in Fig. 15, the cleat-guide-bars rest upon the cross-bars B', B'', and B''' of the bed-frame, the bars B' and B''' being T-shaped in cross-section. On each of the guide-bars B, B, B, of the bar B' is a [illegible] to clamp the bar B'. Also on each [illegible] to clamp the bar B'''. When the guide-bars B B are adjusted as described, they may be [illegible] by means of the thumb-screws a'' and a'''. The intermediate guide-bars B are adjusted by sliding them by hand to the desired positions to operate as guides for the cleats N, and they are tightened in adjusted positions by means of their thumb-screws a'' and a'''. As before described, the lower rear guide-wheels C' are adjusted upon the shafts C C' in the movement of the guide-bars B B.

The staple-forming and driving devices T are fastened at their body-portions upon the beam A' by means of thumb-screws T', as indicated in Fig. 4. On the beam A', as indicated at a' in Figs. 6 and 7, is a scale marked with inches, and the staple-forming and driving devices are positioned by means of this scale to extend over the paths of the cleats N N. The operating-bars T' of the staple-forming and driving machines are connected by means of suitable clamps or clamp-blocks T'' to the cross-head N, as indicated in Fig. 4, and when adjusted they are clamped in place by means of screws T'. The clenchers V are also adjusted by turning the wheels V' thereon to cause the clencher-heads or anvils V'' in the rise of the cross-head N' to just reach the plane of the under surfaces of the cleats. The scale on the disk Q' (see Fig. 30) will indicate the distance of travel of the arm or tripping device Q'' with reference to the movement of material through the machine. The posts Q', Q', Q', and Q' are adjusted in the T-groove Q to cause the arm or tripping device to reach the post Q' when the first skip is to be made, the post Q' when the second skip is to be made, the post Q' when the third skip is to be made, and the post Q' when the strengthening-wires are to be severed and the machine stopped.

The distances that parts will be moved with each rotation of the drive-shaft to feed the material are regulated

at the disk E by adjusting the various bolts in the openings y y y^2 y^2 and the downward distance that the material is moved under the action of the skipper mechanism is regulated by the adjustment of the plunger rod r in the lug of the bell-crank lever r' r^2 according to the speed and nature of the material.

The parts having adjusted as described, the operation will be as follows: Before starting the machine the operating handle M is turned, as before described, to raise the forward feed-roller r and lower the stops n^2, as shown in Fig. 37, and cleats N N are placed in the guides B B B against the stops n^2. A sheet N' is then placed upon the cleats against the stops n^2, and the handle n' is turned to depress the said roller r and raise the stops n^2 to the positions shown in Figs. 30 and 38. The primary feed-rollers r r and secondary feed-rollers r' are roughened or serrated, as shown, to enable them to grip the material firmly, and it will be understood that they all rotate at the same rate of speed except when the primary rollers are accelerated by being driven from the pulley L, as described, or the secondary rollers are accelerated by the skipper mechanism. In the latter instance the primary rollers would also be accelerated under the dragging force of the material at engaging the latter. The lever L may then be turned to raise the shaft F so as to be rotated from the pulley L and rotate the primary feed-rollers to feed the material forward as far as the staple forming and driving devices. In practice the material will be fed nearly as far as the staple-drivers in the manner described, and then the lever L will be turned to disengage the shaft F from the pulley L, after which the material will be worked forward by means of the handle or lever K' until it is in proper position. After this has been done the handle q is turned to start the machine, as before described. In passing along the guide-bars the sheet is held flat against the cleats by the overlapping guide-flanges n^3 of the outer bars B' B', and the cleats are pressed against the sides of their guides by the spring-fingers n^4. The fingers n^4 nearest the stapling devices are rigid, as before described, and are adjusted to hold the cleats against any lateral play as they pass beneath the staplers. The staples

are formed from wires d, wound upon reels d', and the strengthening wires e are wound upon reels e'. At the reels are suitable tensioning devices e^2 d^2. The operation of the staple forming and driving devices and the construction of the reels and tensioning devices are fully set forth in the patent before referred to and require no description in the present connection. The parts of the machine are so constructed with reference to each other that in each upstroke of the cross-head N staples are formed from the wires d and cut off ready to be driven. At the same time the cross-head V^3 is plunged downward to lower the clenchers, and the disk E is rocked to turn the feed-rollers e^1, feed wheels a^1, and feed wheels C^3. By this means the material is advanced beneath the staple forming and driving machines. In the downward plunge of the stapling devices and simultaneous upward plunge of the clenchers the disk E is rocked in the opposite direction to that described, so that the material will remain stationary. Thus the feed will always alternate in its action with the staple drivers and clenchers. The staples d, as before stated, are driven to straddle the strengthening wires and fasten them and the sheet to the cleats. The strengthening wires are fed by being drawn by the mate[1358] rial after the first staples are driven. With the first advance of the material the arm Q^5 starts from the stop q, moving intermittingly, the same as the feed-wheels. While the machine is thus running the material will be advanced, say, two and one-fourth inches during each upstroke of the staple-drivers, whereby the staples will extend about two and one-fourth inches apart until the arm Q^5 reaches the first post Q^6 to actuate the skipper mechanism. The increased speed momentarily given to the feed-wheels C^3 will advance the material, say, four inches in the simultaneous upstroke of the stapling devices, so that the next staples driven will be four inches from those previously driven, after which the material will be fed at normal speed, whereby the staples are driven two and one-fourth inches apart until the arm Q^5 reaches the stop Q^6, when the material will advance another four inches. This operation is repeated when the arm Q^5 passes the stop Q^6. The accelerated movement of

the wheels $C^{\prime}$ draws the material and through the latter accelerates the rollers $r^{\prime}$ and wheels $w^{\prime}$, so that they will not drag upon the material. When the arm $Q^{\prime}$ passes the stop Q^{11}, it is released, as before described, and returned by its spring q^{11} to its initial position against the stop q^{12}. At the same time the rock-shaft S is turned, as before described, to turn the switch fingers of the stapling devices, whereby in the next and last upstroke of the stapling devices the strengthening-wires c will be severed and afterward automatically advanced, as more fully described in the aforesaid Letters Patent No. 483,254, to cause the ends of the strengthening-wires to extend past the end of the blank, as indicated in Fig. 70.

It is desirable that the machine shall be automatically stopped, as described, when a blank has passed from beneath the stapling devices and the strengthening-wires are cut in order that the operator may make certain that the next material to be operated upon is properly positioned at the staple-drivers to receive the first staples in the proper locations. The first staples must be properly located on the blank, because the feed mechanism in its movement following the first downward stroke of the staplers determines the locations of the skips made by the skipping mechanism, and the skips should be such that staples will be driven at *equal distances* from opposite sides of the box-corner lines x of the blank. As the operator may commence placing cleats and a sheet in position as soon as the material previously fed has passed the first feed-roller r^{6}, the stopping of the machine need be but momentary in each instance.

When it is desired to withdraw a finished blank from the machine before starting up the latter to turn the rear feed-wheels C^{2}, the roller I may be raised to release the blank by lifting the lever P, as before described.

The machine constructed as described is capable of turning out blanks of the dimensions above given at the rate of about two hundred per hour. I wish it to be understood, however, that the mechanisms shown and described may be modified, more especially in the matter of details of construction, without departing from the spirit of my invention as defined by the claims.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a machine for forming box-blanks by tacking a sheet and strengthening-wires to reinforcing-cleats, the combination of guides for the cleats, intermittent feed mechanism for advancing the cleats longitudinally in their guides and with a sheet through the machine, an intermittingly-acting tacking device adjacent to the path of each cleat, alternating in its action with said feed mechanism, to fasten the sheet, by successive operations, to the cleat, means for guiding strengthening-wires with the cleats and sheet across the tacking devices, and relative skipping means actuated by the said feed mechanism, and operating, at predetermined intervals, in the passage of the sheets and cleats through the machine, to accelerate the feed during a single intermittent movement and thereby produce an increase of the distance between points of tacking, substantially as described.

2. In a machine for forming box-blanks by tacking a sheet and strengthening-wires to reinforcing-cleats, the combination of guides for the cleats, intermittent feed mechanism for advancing the cleats longitudinally in their guides, and with a sheet through the machine, comprising primary and secondary feed-rollers rotating normally at the same rate of speed, an intermittingly-acting tacking device adjacent to the path of each cleat, alternating in its action with said feed mechanism, to fasten the sheet, by successive operations, to the cleat, means for guiding strengthening-wires with the cleats and sheet across the tacking devices, and relative skipping means actuated by the said secondary feed-rollers, at predetermined intervals, in the passage of the sheets and cleats through the machine, to accelerate the feed and thereby produce an increase of the distance between points of tacking, substantially as described.

3. In a machine for forming box-blanks by fastening a sheet and strengthening-wires to reinforcing-cleats, the combination of a drive-shaft, guides for the cleats, intermittent feed mechanism, comprising feed-rollers, a ratchet-wheel geared to the feed-rollers, and a primary ratchet-

wheel-engaging pawl actuated from the drive shaft to turn the said ratchet-wheel and feed-rollers intermittingly to advance the cleats longitudinally in their guides and with the sheet through the machine, an intermittingly-actuated tacking device adjacent to the path of each cleat, alternating in its action with said feed mechanism to fasten the sheet, by successive operations, to the cleat, means for guiding strengthening wires with the cleats and sheet [fol. 1360] across the tacking devices, and relative skipping means, comprising a secondary ratchet-wheel-engaging pawl actuated from the said drive-shaft and normally out of engagement with the said ratchet-wheel, and pawl-engaging means actuated, at predetermined intervals, in the passage of the sheet and cleats through the machine, to move the said secondary pawl into engagement with the ratchet-wheel and thereby accelerate the feed to produce an increase of the distance between points of tacking, substantially as described.

4. In a machine for forming blanks by fastening a sheet to cleats, the combination with intermittingly-actuated tacking devices and with feed mechanism alternating in its action with the tacking devices to feed the sheet and cleats intermittingly across the said devices, of skipper mechanism at the said feed mechanism, operating, at intervals in the passage of the sheet and cleats through the machine, to accelerate the feed and thereby produce an increase of the distance between points of tacking, the said skipper mechanism being adjustable to regulate the said intervals, substantially as described.

5. In a machine for forming blanks by fastening a sheet to cleats, the combination of a drive-shaft, guides for the the cleats, feed mechanism, comprising feed-rollers, a ratchet-wheel geared to said feed-rollers, and primary pawl at the said ratchet-wheel actuated from the drive-shaft for moving the feed-rollers intermittingly to advance the cleats longitudinally in their guides and with the sheet through the machine, an intermittingly-actuated tacking device adjacent to the path of each cleat, alternating in its action with said feed mechanism, to fasten the sheet, by successive operations, to the cleat, and skipper mechanism comprising a secondary pawl actuated from the said drive-

shaft and adjacent to but normally out of engagement with said ratchet wheel, a tripping device movable under the influence of the feed-rollers, a stop in the path of said tripping device, and a connection between said tripping device and secondary pawl, whereby in the engagement of the tripping device with the said stop the said secondary pawl is moved to engage the said ratchet-wheel and thereby increase the movement of the feed-rollers and thus produce an increase of the distance between points of tacking, substantially as described.

6. In a machine for forming blanks by fastening a sheet to cleats, the combination of a drive-shaft, guides for the cleats, feed mechanism comprising feed-rollers, a ratchet-wheel geared to said feed-rollers, and a primary pawl at the said ratchet-wheel actuated from the drive-shaft for moving the feed-rollers intermittingly to advance the cleats longitudinally in their guides and with the sheet through the machine, an intermittingly-actuated tacking device adjacent to the path of each cleat, alternating in its action with said feed mechanism, to fasten the sheet, by successive operations, to the cleat, and skipper mechanism comprising a secondary pawl actuated from the said drive-shaft and adjacent to but normally out of engagement with said ratchet-wheel, a tripping device movable under the influence of the feed-rollers, a scale along which said tripping device moves, a stop adjustable along the said scale and in the path of said tripping device, and a connection between the said tripping device and secondary pawl, whereby in the engagement of the tripping device with the said stop the said secondary pawl is moved to engage the said ratchet-wheel and thereby increase the movement of the feed-rollers and produce an increase of the distance between points of tacking, substantially as described.

7. In a machine for forming box-blanks by fastening a sheet and strengthening wires to cleats, the combination of a drive-pulley provided with a clutch member, a drive-shaft provided with a clutch member, shipping mechanism for said clutch members operating to throw them into and out of engagement to throw the drive-shaft into and out of engagement with its driving-pulley, guides for the cleats, intermittent feed mechanism, actuated from the said drive-

shaft for advancing the cleats longitudinally in their guides and with the sheet through the machine, a tacking device adjacent to the path of each cleat and operated intermittingly from the said drive-shaft to alternate in its action with said feed mechanism and fasten the sheet, by successive operations, to the cleats, relative skipping means actuated by the said feed mechanism, at predetermined intervals, to accelerate the feed and thereby produce an increase of the distance between points of tacking in a single intermittent movement of the feed, and means actuated by the said feed mechanism for moving the said clutch-shipping mechanism to stop the machine, substantially as and for the purpose set forth.

8. In a machine for forming box-blanks by fastening sheets and strengthening-wires to reinforcing-cleats, the combination of guides for the cleats, intermittent feed mechanism for advancing the cleats longitudinally in their guides and with a sheet through the machine, an intermittingly-actuated staple-driver adjacent to the path of each cleat, alternating in its action with said feed mechanism, to fasten the sheet and strengthening-wires, by successive operations, to the cleats, means for guiding the strengthening-wires with the sheet across the staple-drivers, and relative skipping means operating, at predetermined intervals, in the passage of the sheet and cleats through the machine, to accelerate the feed and thereby produce an increase of the distance between the points at which the staples are driven in a single intermittent movement of the feed, substantially as described.

9. In a machine for forming box-blanks by fastening [fol. 1361] sheets and strengthening-wires to reinforcing-cleats, the combination of guides for the cleats, intermittent feed mechanism for advancing the cleats longitudinally in their guides and with a sheet through the machine, an intermittingly-actuated staple-driver adjacent to the path of each cleat, alternating in its action with said feed mechanism, to fasten the sheet and strengthening-wires, by successive operations, to the cleats, means for guiding the strengthening-wires with the sheet across the staple-drivers, relative skipping means actuated by the said feed mechanism at predetermined intervals, in the passage of

the sheet and cleats through the machine, to accelerate the feed and thereby produce an increase of the distance between the points at which the staples are driven in a single intermittent of the feed, and strengthening-wire-severing mechanism actuated from the said feed mechanism, to sever the strengthening-wires when the sheet and cleats have passed the staple-drivers, substantially as described.

10. In a machine for forming box-blanks by fastening sheets and strengthening-wires to reinforcing-cleats, the combination of a drive-shaft and driver therefor, clutch mechanism between the said driver and shaft, clutch-shipping mechanism, guides for the cleats, intermittent feed mechanism actuated from the said drive-shaft for advancing the cleats longitudinally in their guides and with a sheet through the machine, an intermittingly-actuated staple-driver adjacent to the path of each cleat, operated from the said drive-shaft and alternating in its action with said feed mechanism to fasten the sheet and strengthening-wires, by successive operations, to the cleats at intervals in the direction longitudinally of the cleat, means for guiding strengthening-wires with the sheet across the staple-drivers, relative skipping means actuated by the said feed mechanism at predetermined intervals in the passage of the sheet and cleats through the machine, to accelerate the feed and thereby produce an increase of the distance between points at which staples are driven in a single intermittent movement of the feed, and means, actuated from the said feed mechanism, for moving the said clutch-shipping mechanism to stop the machine when the cleats and sheet have passed the staple-drivers, substantially as described.

11. In a machine for forming blanks by fastening a sheet to cleats, the combination of guides for the cleats, intermittent feed mechanism, for advancing the cleats longitudinally in their guides and with the sheet through the machine, comprising primary and secondary feed-rollers rotating normally at the same rate of speed, an intermittingly-actuated tacking device adjacent to the path of each cleat, alternating in its action with said feed mechanism to fasten the sheet, by successive operations, to the cleats, and means for increasing the movement of the primary feed-rollers

to hasten the movement of the sheet and cleats toward the tacking devices, substantially as described.

12. In a machine for forming blanks by fastening a sheet to cleats, the combination of laterally adjustable guides for the cleats, intermittent feed mechanism, for advancing the cleats longitudinally in their guides and with the sheet through the machine, the said feed mechanism being formed with feed-rollers extending crosswise of the machine in the plane above the said guides and feed-wheels journaled in the said guides, an intermittingly-actuated tacking device supported adjacent to the path of each cleat and laterally adjustable on its support and alternating in its action with the said feed mechanism to fasten the sheet, by successive operations, to the cleats, substantially as described.

13. In a machine for forming blanks by fastening a sheet to cleats, the combination of a main drive-shaft, guides for the cleats, intermittent feed mechanism, for advancing the cleats longitudinally in their guides, and with the sheet through the machine, comprising primary and secondary feed-rollers rotating normally at the same rate of speed, an intermittingly-actuated tacking device adjacent to the path of each cleat, alternating in its action with said feed mechanism, to fasten the sheet, by successive operations, to the cleats, a secondary drive-shaft actuated from the main drive-shaft and to which the primary feed-rollers are geared, and means for increasing the movement of the primary feed-rollers, to hasten the movement of the sheet and cleats toward the tacking devices, comprising speed-gear mechanism actuated from the main drive-shaft and with which the said secondary drive-shaft may be thrown into and out of engagement at will, substantially as described.

14. In a machine for forming blanks by fastening a sheet to cleats, the combination of a main drive-shaft, guides for the cleats, intermittent feed mechanism, for advancing the cleats longitudinally in their guides, and with the sheet through the machine, comprising primary and secondary feed-rolllers rotating normally at the same rate of speed, an intermittingly-actuated tacking device adjacent to the path of each cleat, alternating in its action with said feed mechanism, to fasten the sheet, by successive operations, to the cleats, a secondary drive-shaft actuated from the

main drive-shaft and to which the primary feed-rollers are geared, and means for rotating the said secondary drive-shaft independently of the main drive-shaft, comprising pawl-and-ratchet mechanism at the secondary drive-shaft, and an operating handle therefor, substantially as and for the purpose set forth.

15. In a machine for forming blanks by fastening a sheet to cleats, the combination with the guides for the cleats and intermittent tacking devices at said guides, of intermittent [fol. 1362] feed mechanism for advancing the cleats longitudinally in their guides and with the sheet through the machine, comprising a series of upper and lower feed-rollers, between the forward end of the guides and tacking devices and lever mechanism operative at will to raise the first upper feed-roller and the upper feed-roller adjacent to said tacking devices, substantially as and for the purpose set forth.

16. In a machine for forming blanks by fastening a sheet to cleats, the combination with intermittingly-actuated tacking devices, of outer and intermediate guides for the cleats, yielding guides for the edges of the sheet on the said outer cleat-guides, and intermittingly-actuated feed mechanism for advancing the sheet and cleats in their guides longitudinally across the said tacking devices, the said feed mechanism alternating in its action with the said tacking devices, substantially as described.

17. In a machine for forming blanks by fastening a sheet to cleats, the combination with intermittingly-actuated tacking devices, of guides for the cleats, yielding guides for the edges of the sheet, overlapping guides for the edge portions of the sheet and feed mechanism for advancing the sheet and cleats in their guides longitudinally across the said tacking devices, the said feed mechanism alternating in its action with the said tacking devices, substantially as described.

Jacob Uhri.

In presence of M. J. Frost, J. N. Hanson.

(Here follow side folios 1363-1394.)

No. 608,917. Patented Aug. 9, 1898.

F. P. ROSBACK.

BOX NAILING AND PRINTING MACHINE.

(Application filed Dec. 7, 1897.

No Model.) 16 Sheets—Sheet 1.

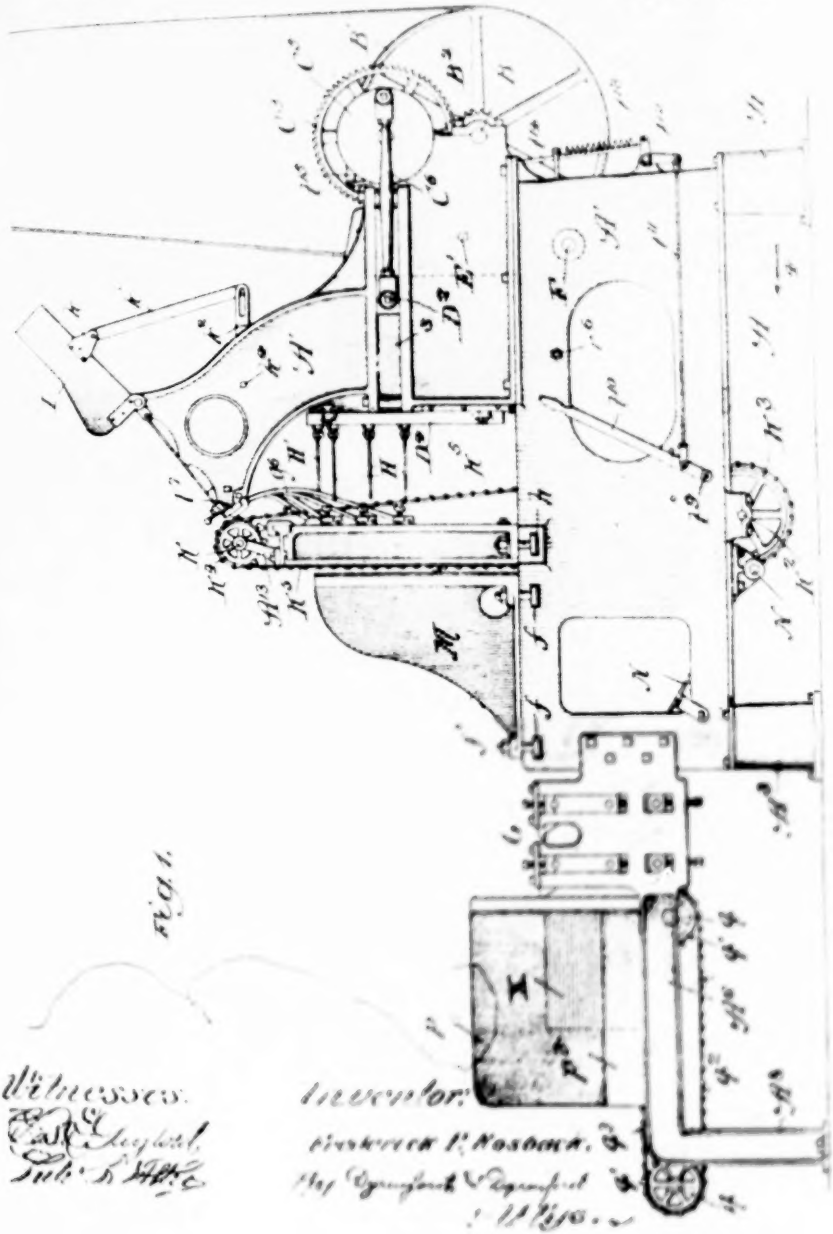


FIG. 1.

Witnesses:
Chas. E. Seybold.
Jule's B. Hill.

Inventor:
Frederick P. Rosback.
by Dyrenforth & Dyrenforth
Attys.

1365-1366

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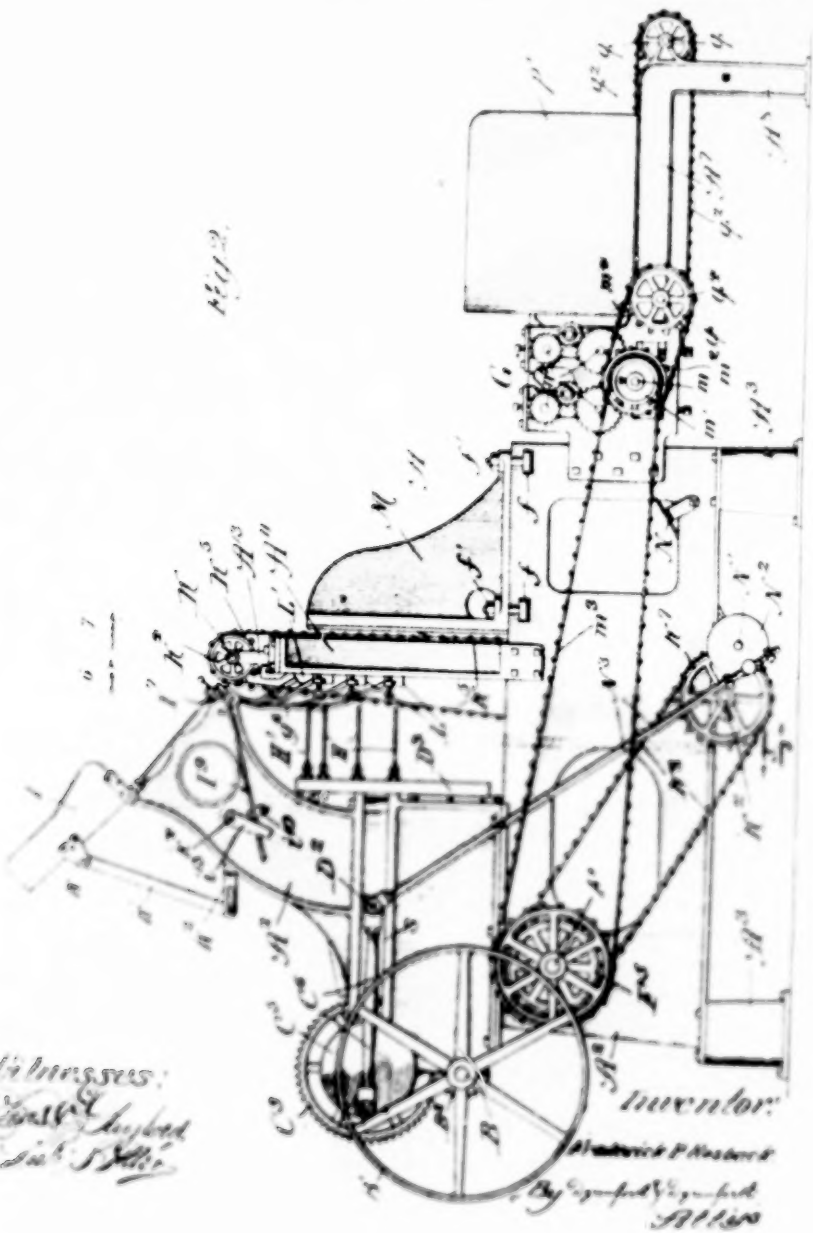
F. J. ROSBACK.

BOX NAILING AND PRINTING MACHINE

(No Model.) (Application filed Dec. 7, 1897.)

16 Sheets—Sheet 2.



Witnesses:

Inventor:

1367-1368

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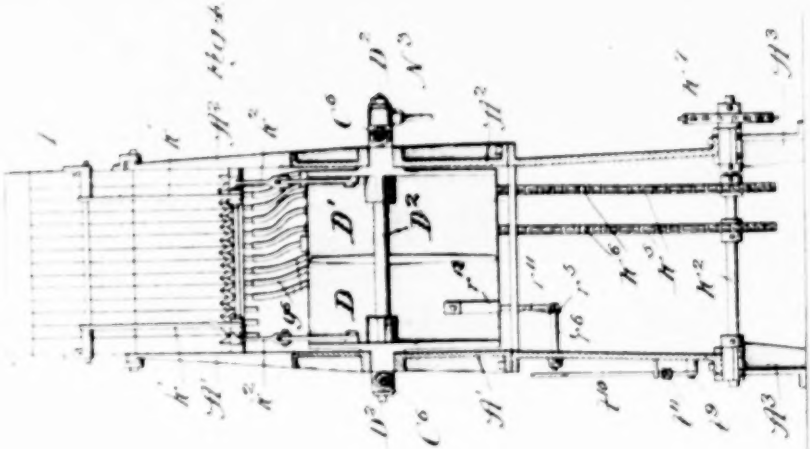
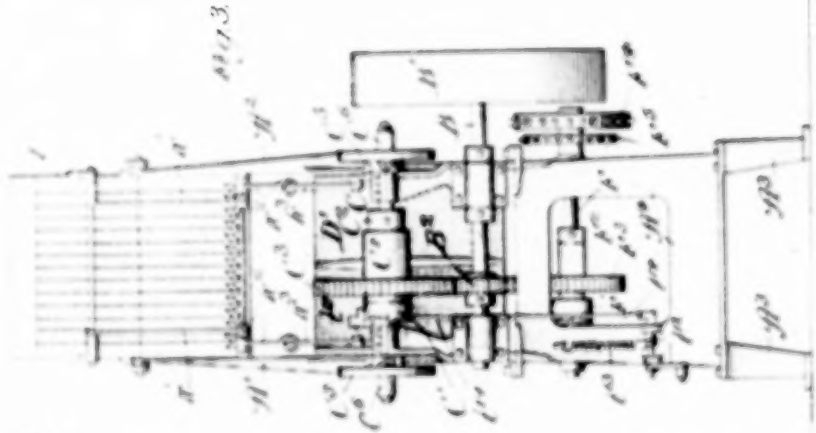
F. P. ROSBACK.

BOX NAILING AND PRINTING MACHINE

Application filed Dec. 7, 1897.

No Model. 16 Sheets—Sheet 3.





Witnesses:

Inventor:

No. 608,917. Patented Aug. 9, 1898.

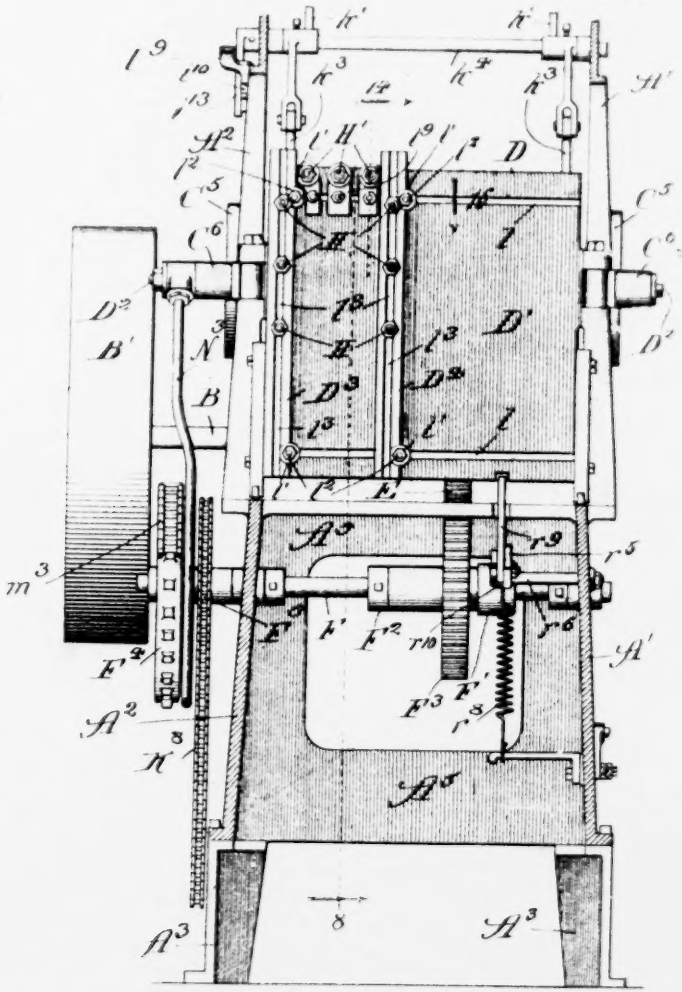
F. P. ROSBACK.

BOX NAILING AND PRINTING MACHINE.

(No Model.) (Application filed Dec. 7, 1897.)

16 Sheets—Sheet 4.

Fig. 5.



Witnesses:
Chas. E. Seybold.
Julius D. Pitts.

Inventor:
Frederick P. Rosback.
By Dyrenforth & Dyrenforth
Attys.

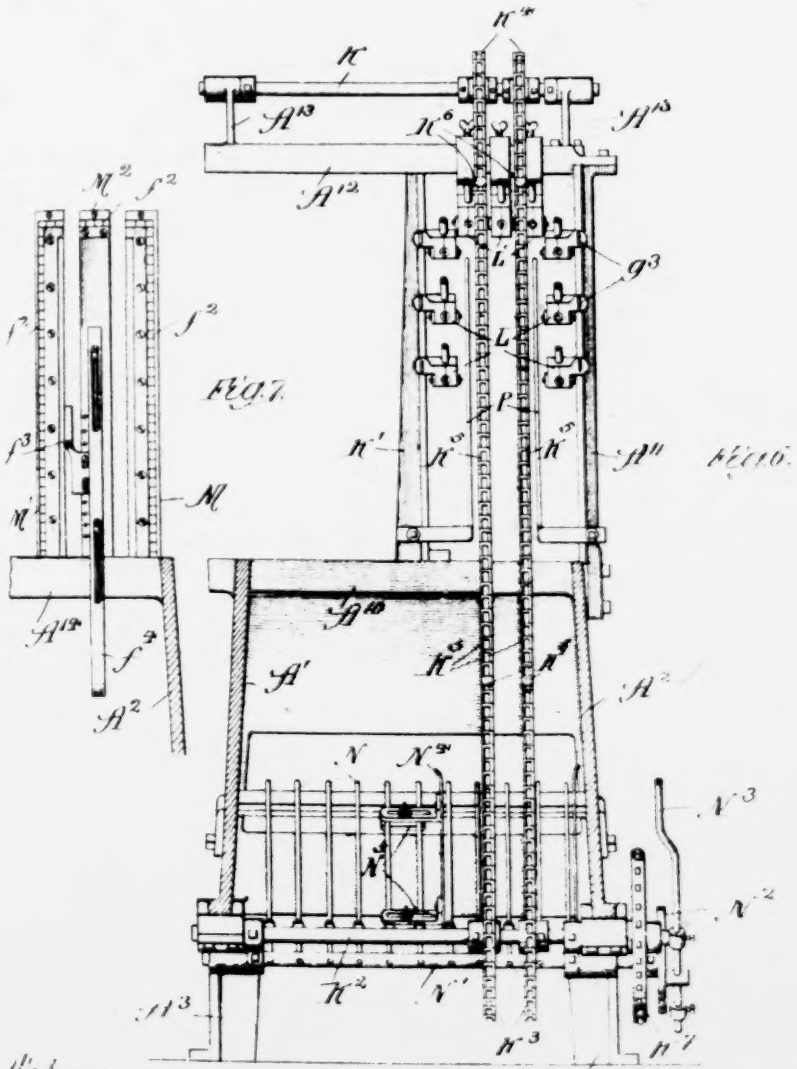
No. 608,917. Patented Aug. 9, 1898.

F. P. ROSBACK.

BOX NAILING AND PRINTING MACHINE.

(Application filed Dec. 7, 1897.)

(No Model.) 16 Sheets—Sheet 5



Witnesses:
Chas. E. Shubert
Jule S. Hills.

Inventor:
Frederick P. Rosback,
By Comfort & Comfort
Attys.

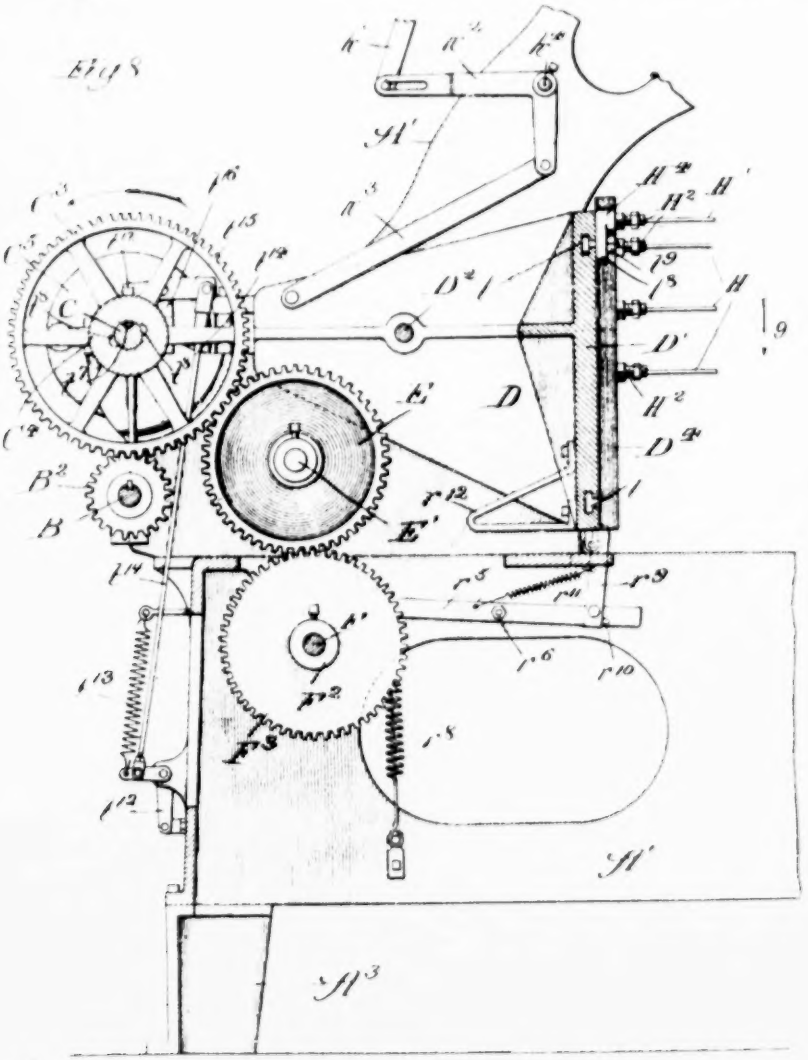
No. 608,917 Patented Aug. 9, 1898.

F. P. ROSBACK.

BOX NAILING AND PRINTING MACHINE.

Application filed Dec. 7, 1897.

No Model. 16 Sheets—Sheet 8.



Witnesses.

Inventor:

Frederick P. Rosback

By Dyrenforth & Dyrenforth

Attorneys.

No. 608,917. Patented Aug. 9, 1898.

F. P. ROSBACK.

BOX NAILING AND PRINTING MACHINE.

(Application filed Dec. 7, 1897.)

(No Model.) 16 Sheets—Sheet 7.

Fig. 9.

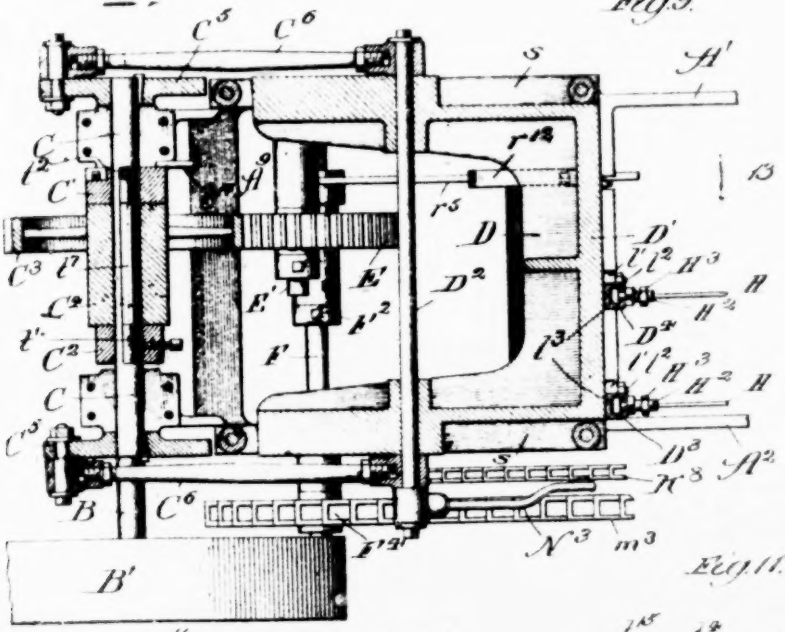


Fig. 11.

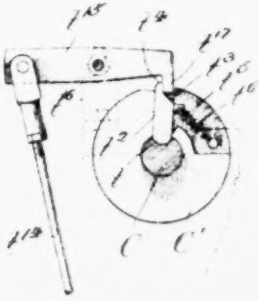
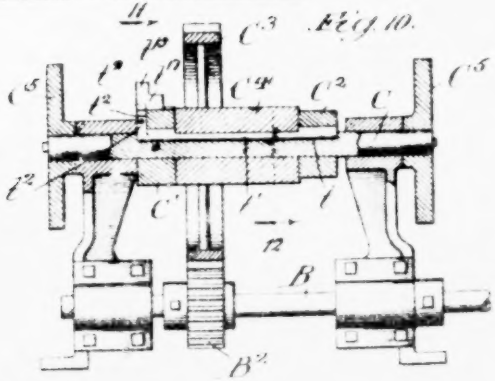


Fig. 10.



Witnesses.
Chas. E. Taylord.
Fitz P. Shaw.

Inventor.
Frederick P. Rosback.
By Dyrenforth & Dyrenforth
Attys.

1377-1378

No. 608,917 Patented Aug. 9, 1898

F. P. ROSBACK.

BOX MAILING AND PRINTING MACHINE.

(Application filed Dec. 7, 1897.)

(No Model.) 18 Sheets—Sheet 8

Fig. 12.

Fig. 13.

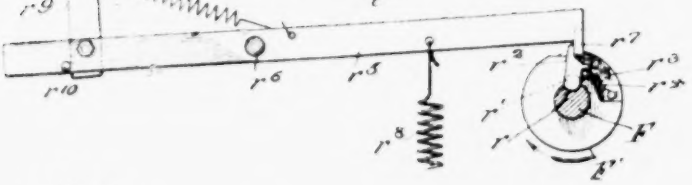


Fig. 14.

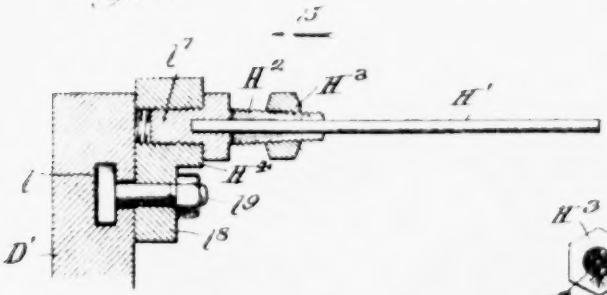


Fig. 15.

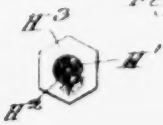
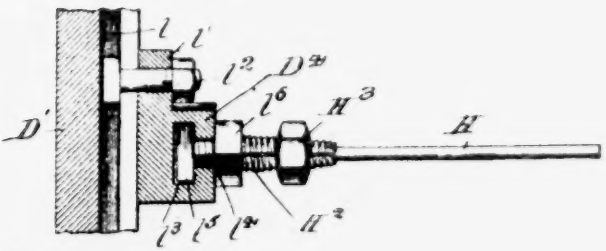


Fig. 16.



Witnesses:
Chas. E. Taylor.
Geo. S. Hitz.

Inventor:
Frederick P. Rosback,
By Dyrenforth & Dyrenforth
Attys.

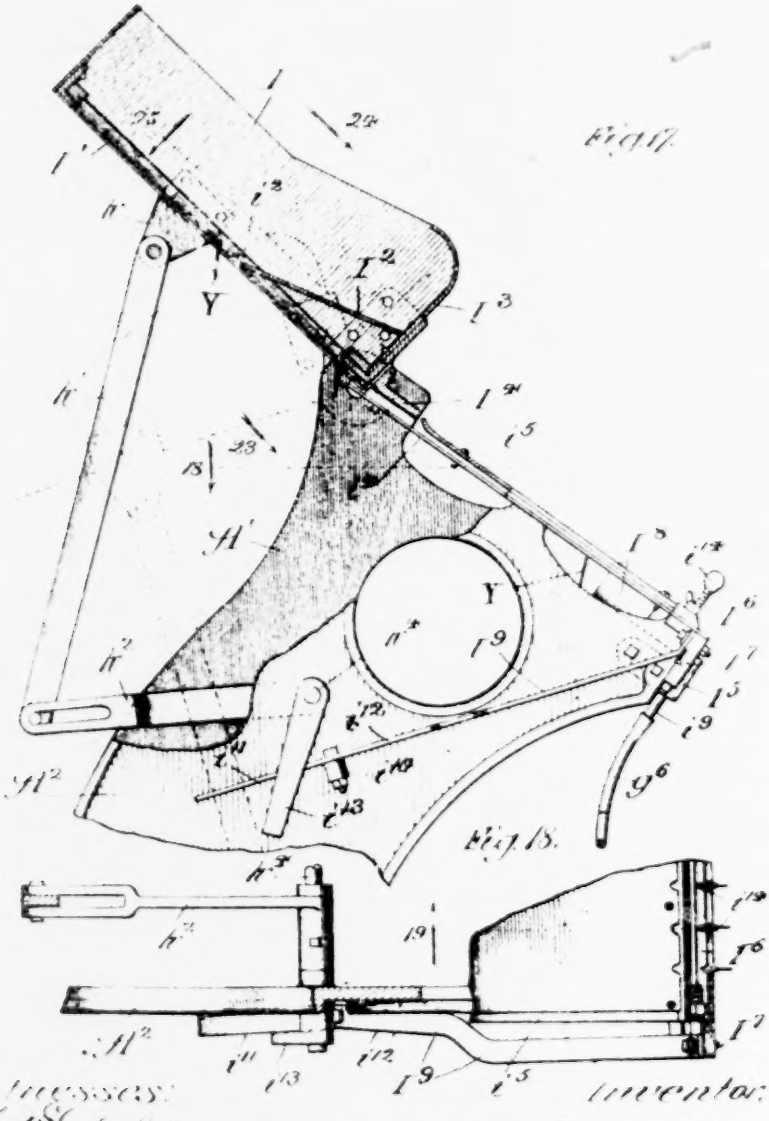
No. 608,917. Patented Aug. 9, 1898.

F. P. ROSBACK.

BOX NAILING AND PRINTING MACHINE

(Application filed Dec. 7, 1897.)

(No Model.) 16 Sheets—Sheet 9



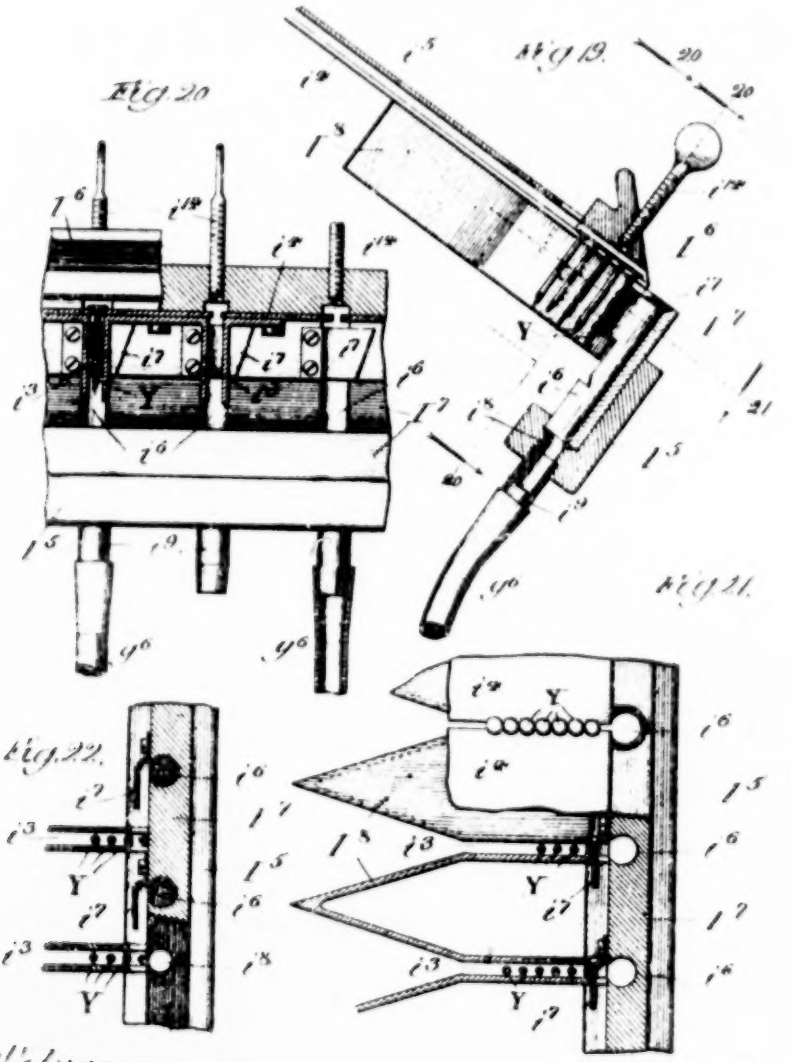
No. 608,917. Patented Aug. 9, 1898.

F. P. ROSBACK.

BOX NAILING AND PRINTING MACHINE

(Application filed Dec. 7, 1897.)

(No Model.) 16 Sheets—Sheet 10.



Witnesses:
[illegible]

Inventor:
Frederick P. Rosback.
By Dyrenforth & Dyrenforth,
Attys.

No. 608,917. Patented Aug. 9, 1898.

F. P. ROSBACK.

BOX NAILING AND PRINTING MACHINE.

(Application filed [illegible], 1897.)

No Model.) 16 Sheets—Sheet 11.

Fig. 24.

Fig. 25.

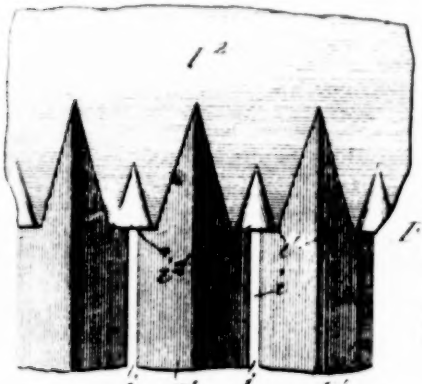


Fig. 23.

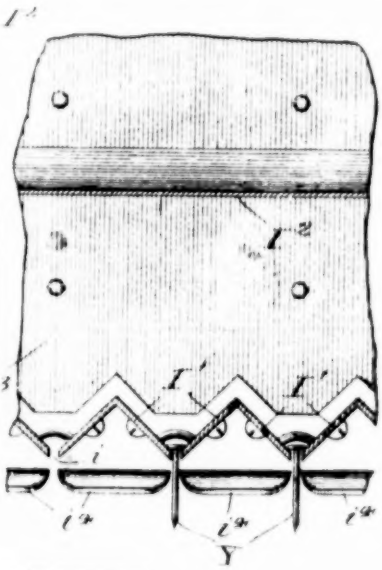
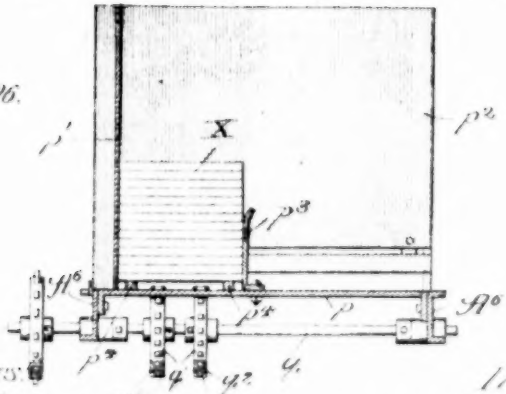


Fig. 26.



Witnesses:
[illegible]

Inventor:
Frederick P. Rosback,
By [illegible]
Attorneys.

385-1386

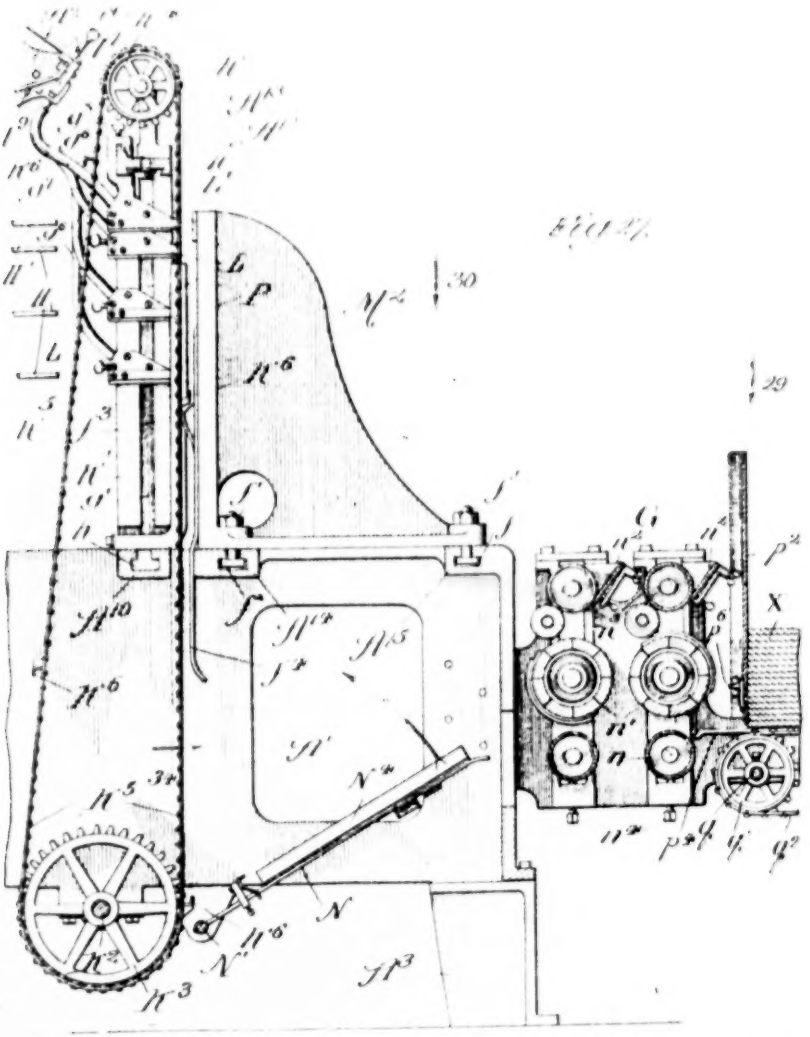
No. 608,917. Patented Aug. 9, 1898.

F. P. ROSBACK.

BOX NAILING AND PRINTING MACHINE.

Application filed Dec. 7, 1897.

(No Model.) 16 Sheets—Sheet 12.



Witnesses:
Chas. E. Hoyland,
Inventor:
Frederick P. Rosback,
By Dyrenforth & Dyrenforth,
Attorneys.

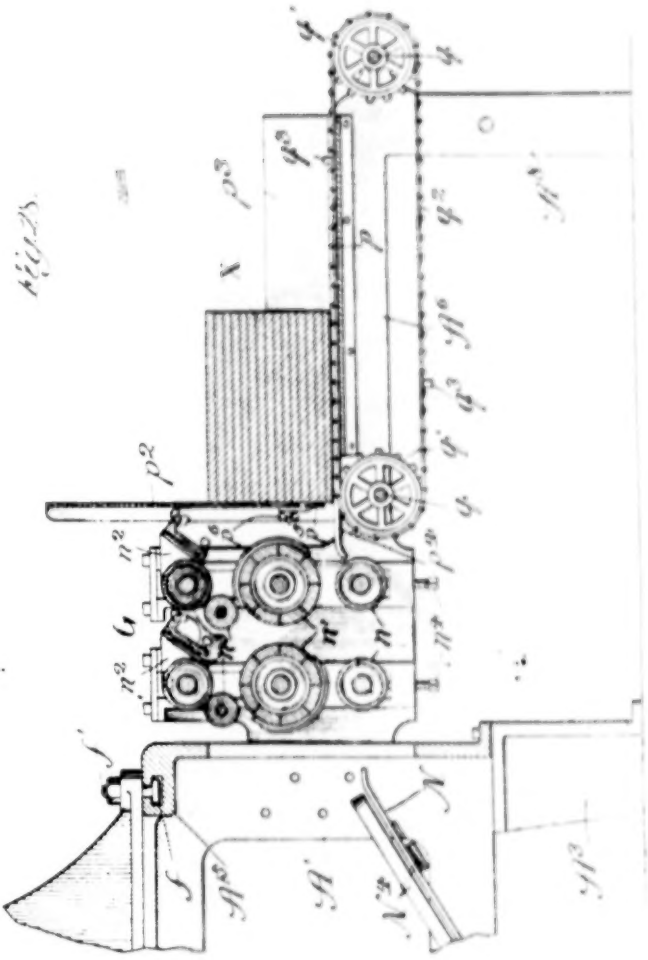
No. 608,917. Patented Aug. 9, 1898.

F. P. ROSBACK.

BOX NAILING AND PRINTING MACHINE

(Application filed Dec. 7, 1897.)

(No Model.) 16 Sheets—Sheet 13.



Witnesses:
Chas. E. Gaylord
Luke S. Miller

Inventor:
Frederick P. Rosback.
By Dyrenforth & Dyrenforth
Attorneys.

389-1390

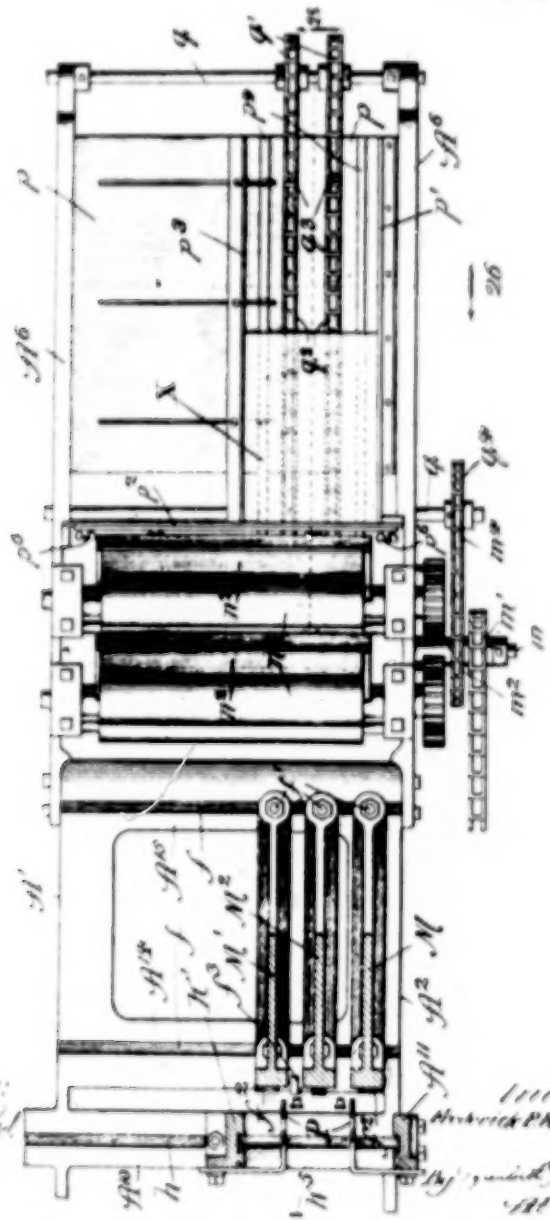
No. 608,917. Patented Aug. 9, 1898.

F. P. ROSBACK.

BOX NAILING AND PRINTING MACHINE.

(Application filed Dec. 7, 1897.)

(No Model.) 16 Sheets—Sheet 14



Witnesses:

Inventor:
Frederick P. Rosback.

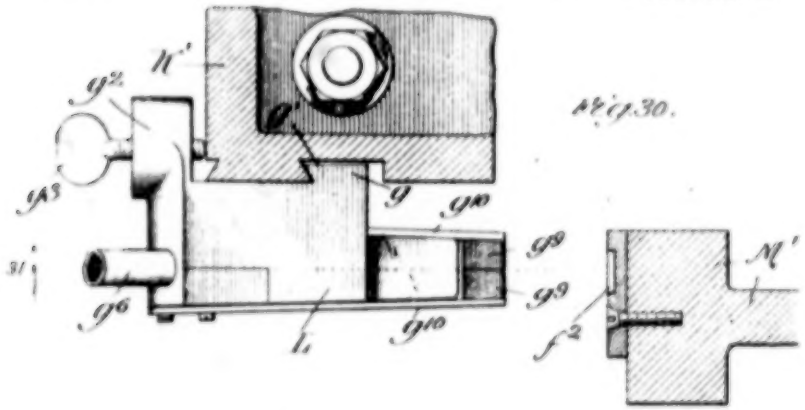
No. 608,917. Patented Aug. 9, 1898.

F. P. ROSBACK.

BOX NAILING AND PRINTING MACHINE.

(Application filed Dec. 7, 1897.)

(No Model.) 16 Sheets—Sheet 15.



3-1394

No. 608,917. Patented Aug. 9, 1898

F. P. ROSBACK.

BOX NAILING AND PRINTING MACHINE

(Application filed Dec. 7, 1897.)

(No Model.) 16 Sheets—Sheet 16.

Fig. 34.

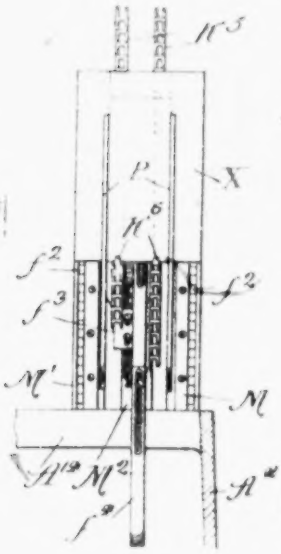


Fig. 35.

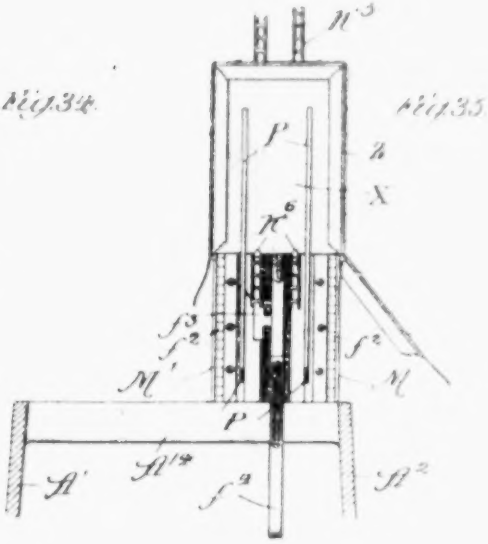


Fig. 36.

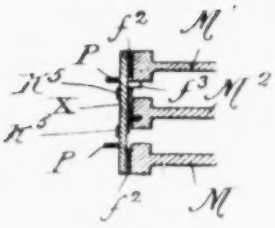
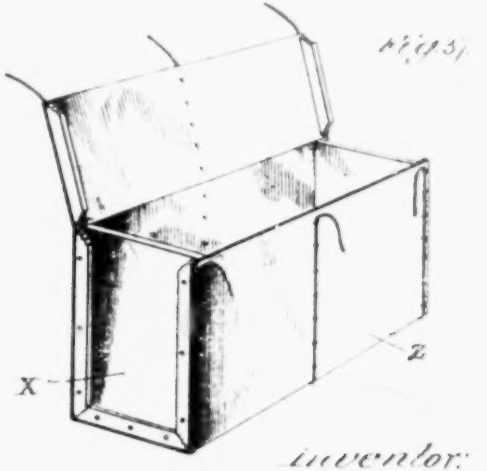


Fig. 37.



Witnesses:
Chas. E. Langford
Luke S. Stiles

Inventor:
Frederick P. Rosback
By Dyrenforth & Dyrenforth
Attys.

[fol. 1395] United States Patent Office

Frederick P. Rosback, of Chicago, Illinois, Assignor to William P. Healy, of Same Place

Box Nailing and Printing Machine

Specification Forming Part of Letters Patent No. 608,917, Dated August 9, 1898. Application Filed December 7, 1897. Serial No. 661,031. (No model.)

To all whom it may concern:

Be it known that I, Frederick P. Rosback, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Box Nailing and Printing Machines, of which the following is a specification.

This invention relates to box-nailing machines generally, and more especially to an improved machine for use in the construction of wire-bound packing boxes to fasten the ends of the boxes in place by nailing them to the end reinforcing-cleats. The machine is also provided with printing mechanism, whereby advertisements may be printed upon the ends of the boxes.

My object is to provide a machine of generally-improved construction, adapting it more especially for fastening the sides and bottom to the ends in the construction of wire-bound boxes, whereby the operation may be performed with economy in time and labor. The wire-bound box referred to consists of a sheet in one or more sections, reinforced on one side with cleats and at its opposite side with strengthening-wires, the sheet and wires being fastened with staples to the cleats, and the blank thus formed being step-mitered and bent at the step-miter cuts to form the top, bottom, and sides of the box. A wire-bound box is shown in perspective in Figure 37. These boxes may be of any size and shape and are particularly desirable on account of their strength and lightness.

My invention is not to be limited to the use of printing mechanism in combination with the box-nailing mechanism, because my primary object is to provide a machine which will drive nails at three edges of the box end in one opera-

tion, and the printing of the box ends, though very desirable in many instances, is a secondary object.

In the drawings, Fig. 1 is a side elevation of my improved box nailing and printing machine; Fig. 2, an elevation of the opposite side of the machine; Fig. 3, a rear end elevation thereof; Fig. 4, a vertical section taken on line 4 of Fig. 1; Figs. 5, 6, and 7, enlarged broken sections taken on lines 5, 6, and 7 of Fig. 2; Fig. 8, an enlarged broken section taken on line 8 of Fig. 5; Fig. 9, a broken plan section taken on line 9 of Fig. 8; Fig. 10, a broken section taken on line 10 of Fig. 9 and showing details of clutch mechanism; Figs. 11 and 12, sections taken, respectively, on lines 11 and 12 of Fig. 10; Fig. 13, an enlarged sectional detail view of another clutch mechanism, the section being taken on line 13 of Fig. 9; Fig. 14, an enlarged and broken section taken on line 14 of Fig. 5 and illustrating the construction of one of the nail-drivers; Fig. 15, a section taken on line 15 of Fig. 14; Fig. 16, a section taken on line 16 of Fig. 5; Fig. 17, an enlarged broken view, partly in section and partly in side elevation, illustrating nail-feeding mechanism; Fig. 18, a broken sectional view taken on line 18 of Fig. 17; Fig. 19, a broken section taken on line 19 of Fig. 18; Fig. 20, a broken view showing sections taken on the lines 20 20 of Fig. 19; Fig. 21, a broken view, partly plan and partly sectional, the section being taken on line 21 of Fig. 19; Fig. 22, a broken section illustrating details of construction of the parts illustrated in Figs. 17 to 21, inclusive; Figs. 23, 24, and 25, broken sectional plan views taken on lines 23, 24, and 25 of Fig. 17; Fig. 26, a sectional view illustrating box-end-feeding mechanism, the section being taken on line 26 of Fig. 29; Fig. 27, an enlarged broken sectional view taken on line 27 of Fig. 6; Fig. 28, a sectional view, also taken on line 27 of Fig. 6 and in the nature of a continuation of Fig. 27; Fig. 29, a sectional plan view taken on line 29 of Fig. 27; Fig. 30, an enlarged section taken on line 30 of Fig. 27; Fig. 31, a section taken on line 31 of Fig. 30 and illustrating the nail feeding and positioning mechanism and the manner in which a nail is driven and clenched; Fig. 32, a section taken on line 32 of Fig. 31; Fig. 33, a broken section taken on line 33 of Fig. 31; Fig. 34, a broken section taken on line 34 of Fig. 27 and showing a box end in position to receive

the sides of the box; Fig. 35, a view, the same as Fig. 34, showing the sides of a box folded upon the box end ready for the nailing operation; Fig. 36, a broken plan section taken on line 36 of Fig. 34, and Fig. 37 a perspective view of a completely wire-bound box.

[fol. 1336] In each instance sectional figures are to be viewed in the direction of the arrows at the lines on which the sections are taken.

A is the frame of the machine, formed with side frames or cheeks A' A', mounted upon feet A^*, rear end A^2, cross-braces A^3, and forward cheek extensions A^4 A^4, having legs A^5.

B is the drive-shaft, provided with a pulley B', which is belted to a pulley on a line-shaft or the like to rotate and turn the shaft B constantly. Fixed to the shaft B is a pinion B^2. Journaled in the cheeks above the shaft B is a counter-shaft C. On the shaft C are two fixed collars C' C^2, and between the collars is a gear-wheel C^3, having a hub C^4, which is normally loose upon the shaft C. The gear-wheel C^3 meshes with the pinion B^2 and rotates constantly, but being normally loose upon the shaft C the latter is normally at rest.

In the shaft C (see Figs. 10, 11, and 12) is a longitudinally-extending concave recess t of a length which causes it to extend beneath the collars C' C^2 and hub C^4. Resting in the recess t is a rocking clutch-pin t', provided at one end with a laterally-extending arm t^2, having a cam edge t^3 and stop projection t^4. In the collar C' is a radial-recess t^5, through which the arm t^2 extends, and in the said recess and connected at one end with the arm t^2 and at its opposite end to the collar is a spring t^6. The pin t' is cylindrical at the ends; but between the ends, where it passes through the hub C^4, it is half-round, being formed so by a recess t^7 in the pin. The spring t^6 tends to draw the arm t^2 and rock the pin to the position indicated in Fig. 12, whereby it will engage one of two recesses or notches t^8 in the inner circumference of the hub C^4. When the arm t^2 is in the position indicated in Fig. 11, the pin t' is rocked to the left from the position shown in Fig 12, whereby the halfround portion of the pin is altogether in the recess t of the shaft, and the hub will move over it without being engaged by the pin. In other words, when the parts

are in the position shown in Fig. 11 the gear-wheel C^3 rotates loosely upon the shaft C, and when the parts are in the position shown in Fig. 12 the shaft C is locked to the gear-wheel C^3 and rotates therewith. Fulcrumed at t^9 on the cheek A' is a lever t^{10}, connected by a rod t^{11} with a bell-crank lever t^{12}, held normally in the position shown in Fig. 1 by a spring t^{13}. Connected at its lower end with an arm of the bell-crank lever is an upward-extending rod t^{14}. (See Fig. 11.) A lever t^{15}, fulcrumed between its ends on a bracket t^{16} at the cheek A' is pivotally connected at one end to the rod t^{14} and at its opposite end carries a downward-projecting lip t^{17}, which in the rotation of the collar C'' rides upon the circumference thereof and tends to engage the projecting end portion t^4 of the arm t^2.

In the operation of the machine the intention is to cause the shaft C to be given one complete revolution and then stop. Thus when it is desired that the shaft C and attendant parts shall rotate the handle t^{10} is moved by the operator to the left in Fig. 1 to swing the bell-crank lever t^{12} against the resistance of the spring t^{13} and draw down the rod t^{14}, whereby the lever t^{15} is turned to lift the lip t^{17} out of engagement with the arm t^2. This permits the spring t^7 to rock the pin t' on its axis as soon as a recess t^5 registers therewith, whereby it will project into the recess t^5 and lock the shaft C to the rotating gear-wheel C^3. The handle t^{10} is then immediately released by the operator, whereby the spring t^{13} exerts itself to press the stop t^{17} upon the circumference of the collar C''. Thus when the shaft C and collar C'' have nearly completed a revolution the lip t^{17} engages the arm t^2 and swings it to the position shown in Fig. 11 just as the shaft has completed a revolution, thereby releasing the shaft from the rotating gear C^3.

In the cheeks A' A^2 are coincident horizontal cross-head guide-openings *s* for a cross head or ram D, having a vertical face-plate D'. Extending through the ram D and beyond the guides *s* is a shaft D^2. On the shaft C and keyed to opposite ends thereof are disks C^5 C^5, with which pitmen C^6 are eccentrically connected. At their opposite ends the pitmen are pivotally connected to the end of the shaft D^2, whereby in each revolution of the shaft C the ram is plunged forward and back in the guides *s*.

E is an intermediate gear-wheel mounted upon a counter-shaft E', journaled in a bearing-sleeve A^6, Fig. 9, secured upon or cast integral with the cheek A'. The gear-wheel E meshes with the gear-wheel C^1, whereby it rotates constantly.

F is a counter-shaft journaled at opposite ends in the cheeks A' A^2. Rigid upon the shaft F are collars F^7 F^8, and confined between the collars and normally loose upon the shaft is a gear-wheel F^3, meshing with the gear-wheel E and rotated constantly thereby. Extending beneath the collars F^7 F^8 and gear-wheel F^3 is a groove or recess f in the shaft F, (see, for example, Fig. 13,) and resting in the said groove is a clutch-pin f', in all respects like the clutch-pin f', before described, and provided with a projecting arm f^2, extending through a radial recess f^3 in the collar F^7 and projecting beyond the circumference of said collar. When the parts are in the position shown in Fig. 13, the gear-wheel F^3 turns loosely on the shaft F, and when the pin f' is rocked to the right by the spring f^4 the clutch-pin locks the gear-wheel and shaft together, whereby the shaft is rotated by the gear-wheel. A lever f^5 is pivoted upon a pin f^6, which projects inward from the cheek A'. On one end of the lever f^5 is a downward-projecting lip f^7, and the lever is held down by a spring f^8 (see Fig. 5) to press at its lip normally upon the circumference of the collar F^7 to engage the projecting arm f^2. On the opposite end portion of the [fol. 1397] lever f^5 is an upward-projecting arm f^9, held normally in an upright position against the stop f^{10} by a spring f^{11}. The arm f^9 extends normally upward into the path of a trip or cam f^{12}, carried by the cross-head or ram D, as shown in Fig. 8. The spring f^{11} is weak as compared with the spring f^8. In the initial or forward movement of the ram D the cam f^{12} at its under surface engages the arm f^9 and swings it backward against the resistance of the spring f^{11} until it is passed by the cam. It then assumes its normal position against the stop f^{10}. In the return or backward movement of the ram the cam f^{12} at its under surface engages the arm f^9, and as the latter is pressed against the stop f^{10} it yields in the downward direction under the cam, swinging the lever f^5 to disengage the lip f^7 from the arm f^2 of the clutch-pin. The hub of the gear-wheel F^3 is provided

on its inner circumference with recesses like the recesses f^5, (shown in Fig. 12,) whereby when the arm r^2 is released by the lip r^3 the pin is turned by the spring r^4 into one of said recesses to clutch the shaft F to the gear-wheel F^3 and cause the former to rotate. Before the shaft has completed a revolution the arm r^6 is released by the cam r^{12} and the lever r^5 is pressed down by the spring r^8, whereby the lip r^7 will catch the projecting arm r^2 and rock the pin to the position of disengaging the shaft F from the gear-wheel F^3. Thus in each operation the shaft F is given one complete revolution.

It will be understood from the above description that when the operator turns the handle f^{10} the drive-shaft B is given one complete revolution and then stopped. In this revolution the ram D is moved first in the forward direction and then back to its initial position. As the shaft B nears the completion of its revolution the cam r^{12} on the ram D turns the clutch mechanism on the shaft F, whereby the said shaft and attendant parts are given a complete revolution and then stopped. The movement of the shafts B F are thus intermittent, and the movement of the shaft F follows that of the shaft B, starting just before the stoppage of the latter.

Journaled in the cheek extensions A^6 A^7 are parallel horizontal shafts q q, (see Figs. 28 and 29,) each carrying a pair of laterally-adjustable sprocket-wheels q', over which run feed-chains q^2, carrying stops or feed projections q^3 q^3. On the cheek extensions is a receptacle for box ends X, comprising a floor or base-plate p, a stationary side plate p', and a vertical back plate p^2. Adjustable laterally upon the base-plate p is a vertical guide-plate p^3. (See Fig. 26.)

The feed-chains q^2 slide upon the base-plate p, and on the said base-plate are longitudinally-extending cleats p^4, on which the box ends X rest out of contact with the chain and in position, whereby the lower box end will be engaged by a stop q^3 and moved from beneath the rest of the pile. Beneath the plate p^2 is an opening partly closed by an adjustable plate p^5, which may be adjusted in accordance with the thickness of the box end and fastened in place by thumb-screws p^6. The opening between the plate p^5 and base p is thus rendered just large enough to permit one box end and no more to pass through at a time.

G is a printing device which, as shown in the drawings, is capable of printing in two colors. It comprises two rollers n, mounted at opposite ends in the cheek extensions, with the highest points of their circumferences in the plane of the cleats or guides p^4. Above the rollers n are printing-cylinders n'. Above the printing-cylinders n' are ink-troughs n^2 and inking-rollers n^3. The rollers n are journaled in boxes which rest upon adjusting-screws n^4, whereby the distance between them and the cylinders may be regulated in accordance with the thickness of the box ends. On the left-hand side of the machine, beyond the cheek extension A', the shafts of the rollers n n' n^2 carry gear wheels and pinions n^5, (see Fig. 2,) which mesh with each other, the lower two gears meshing with a gear-wheel on a shaft m, journaled on the cheek A'. The shaft m also carries sprocket-wheels m' m^2. The sprocket-wheel m' is geared to a sprocket-wheel F' on the shaft F by means of a drive-chain m^3. The sprocket-wheel m^2 is geared to a sprocket-wheel q' on the rear shaft q by means of a drive-chain m^4. Thus each time the shaft F is rotated the feed-chains q^2 move to advance a box end into the printing-machine, and the rollers and cylinders of the printing-machine are rotated to print upon the box end. By providing the two printing mechanisms the box ends may be printed in two colors with suitable advertisements, the feed-chains and printing-cylinders being so geared with relation to each other that the impressions will be suitably placed upon the box ends. In the face-plate D' of the ram D, toward the upper and lower ends thereof, are horizontal T-grooves l. Fitting against the face-plate are vertical nail-driver-attaching bars D^3 D^4, provided at the slots l with laterally-extending ends l', through which extend nut-bolts l^2. (See, for example, Fig. 16.) The bars D^3 D^4 may be adjusted laterally and tightened in adjusted position by means of the nut-bolts l^2, the heads of which engage the T-slots l, as indicated. In the bars D^3 D^4 are longitudinal T-grooves l^3.

H H' are nail-drivers, which at their ends are held in socket-pieces H^2. The socket-pieces H^2 are split and tapering, as shown in Fig. 16, and provided on their outer sides with threads to receive nuts H^3, which when screwed in one direction clamp the drivers firmly in the sockets and when unscrewed loosen the hold of the socket-pieces upon the

drivers, whereby the latter may be removed. The socket-pieces H^2 of the drivers H have threaded shanks l^4, terminating in bolt-heads l^5, and on the shanks are jam-nuts l^6. The bolt-heads and shanks fit the T grooves l^3 of the bars [fol. 1398] D^2 D^4 and may be slid therein to any desired position and tightened in place by means of the jam-nuts l^6. The socket-pieces which hold the drivers H′ are provided with shanks l^7, which screw into blocks H^4, having ears l^8, through which pass nut-bolts l^9, the heads of which slide in the T-grooves l.

As hereinafter described, the nailing operation is performed along three edges only of a wire-bound box, being at the sides and base thereof only. The drivers H are upon the bars D^2 D^4 and the drivers H′ are at the upper T-groove l between the bars D^2 D^4. In Fig. 5 three drivers H are shown at each side and three drivers H′ at the top.

It will be understood that the number of drivers may be increased as desired.

I is a pan or reservoir for nails, hinged at its lower forward corner to the tops of the cheeks A′ A^2. On the under side of the reservoir I, at opposite sides, are ears k, to which are pivoted downward-extending rods k', pivotally connected at their lower ends with bell-crank levers k^2 k^2, secured between their ends to a rock-shaft k^4, journaled in the cheeks A′ A^2. The other arms of the bell-crank levers are pivotally connected to rods k^3, which at their opposite ends are pivotally connected with the sides of the ram D. Thus in the reciprocation of the ram the reservoir I is swung up and down upon its hinge between the positions shown by full lines in Fig. 17 to the position indicated by the dotted lines in that figure. The base I′ of the reservoir I is corrugated, as indicated most clearly in Figs. 23 and 24, longitudinal slots i being provided between the corrugations. In the forward part of the reservoir is an inclined false bottom I^2, which extends from the forward wall I^3. The false bottom I^2 has a corrugated and serrated edge i', which conforms to the corrugated base I′ and slightly fluted at the ends i^2 to permit a nail-head to pass beneath it when the shank of the nail extends through the respective slot i, as indicated in Fig. 17.

The openings afforded by the ends i^2 will not permit a nail-head to pass through unless the shank thereof extends

down through the respective slot i. Extending between the cheeks at the forward edge of the reservoir I is a stationary cross-brace I^4, and at the forward upward edges of the cheeks in the position shown is a cross bar or brace I^5, L-shaped in cross-section, as shown in Fig. 19. Above the cross-bar I^5 in the position shown is a cross-bar I^6. Fastened against the under side of the bar I^6 are a series of V-shaped deflectors I^7, forming between them a series of nail-receiving slots i^2. Extending from the deflectors to the bar I^4 are a series of slats i^4, having openings between them which register with the openings i in the base I' of the nail-reservoir. Extending over the slats i^4 is a plate i^5 close enough to the slats to permit the heads to pass flatwise down the slats and prevent the nails from jarring out.

I^2 is a longitudinally-sliding bar resting upon the L-shaped bar I^5 and provided with a series of vertical openings i^6, cutting through the rear face of the plate. Extending over the sides of the openings on the rear face of the plate are separating fingers or stops i^7. (See, for example, Figs. 20, 21, and 22.) In the bar I^2 and registering with the slots i^2 are openings i^8, at the lower ends of which are short tubes i^9. Fulcrumed at i^{10} on the cheek A^2 is a lever I^3, connected at one end to the sliding bar I^2. The lever is cam-shaped, as shown in Fig. 18, to afford the cam-surfaces i^{11} i^{12} at opposite sides of the fulcrum i^{10}. The bell-crank lever k^2 as before mentioned, is upon the shaft k^3, which passes through the cheek A^2 and carries at its outer end an arm i^{13}, which slides along the cam-surfaces i^{11} i^{12} of the lever I^3. In the movement of the ram D in the forward direction—that is to say, in the direction to the right in Fig. 2—the plate or bar I^2 is moved to the position shown in Fig. 22, whereby the nails Y in the slots i^2 will move by gravity against the surface of the plate or bar, as shown in Fig. 22. In the movement of the ram in the backward direction—that is to say, to the left in Fig. 2—the finger or stops i^7 pass between the first and second nail in each slot i^2 and in the further movement of the bar direct the first nails into the openings i^6 as the said openings register with the openings i^8, whereby the nails drop into the tubular extensions i^9. Thus in the movement of the ram the reservoir I is agitated to distribute the nails in the guide slots in the base I'. The nails rest in the said slots, being prevented

from passing downward in any other position by the false bottom I^3. The nails pass from the openings i to the openings between the slats and are positioned by the V-shaped deflectors I' in the slot i^2, and in each reciprocation of the plate or bar I^3, brought about by the reciprocation of the ram, a nail is fed from each slot i^2 to a tube extension i^3.

Extending between the cheeks, A' A^2 is a cross-bar A^{12}, (see Figs. 6 and 27,) provided in its upper surface with a longitudinal T-slot h. On the cheek A^2 in the position shown is an upright standard A^{13}, (see Figs. 2 and 6,) firmly secured in place. On the top of this standard is a transverse bar A^{14}, also rigid with the frame. On the bar A^{14} are upward-extending brackets A^{15} A^{15}, forming bearings for a horizontal shaft K. The bar A^{12} is provided with a longitudinal slot h'. (See Fig. 27.)

K' is a vertical bar provided at its lower end with a bolt fitting the T-slot h and at its upper end with a bolt which passes through the slot h' in the bar A^{12}. By means of these bolts the upright bar K' may be moved toward or away from the standard A^{13} and fastened in place to the bars A^{12} A^{14}.

L L' (see Fig. 6) are nail holders and guides. The guides L are provided with half-dove-tailed flanges a, (see Fig. 30,) which engage half-dovetailed slots a' in the standard [fol. 1390] A^{13} and upright bar K'; also, on the nail-holders L are flanges a^2, through which extend thumb-screws a^3, which tighten against the bars to hold the parts in adjusted position. Extending through the holders are horizontal openings a^4, to which extend inclined openings a^5. Extending from the openings a^5 are tubes a^6. The tubes a^6 may be made of any number of interfitting or telescoping sections and extend to each one of the tube extensions i^3, before described. The nail-holders L' are formed like the nail-holders L, but are provided with upright extensions a^7, (see Fig. 27,) which engage the bar A^{12} and are rigidly secured thereto in any adjusted position by means of thumb-screws a^8. The drivers H H' are positioned upon the ram to drive nails in proper position with relation to the size of the box to be made, and the nail-holders L L' are so adjusted in position that the drivers H H' in the forward movement of the ram will enter the openings a^4. When a nail drops into a tube extension i^3 and tube a^6, it falls by gravity into a nail-

holder L or L′ and lies in the opening g^4. When a driver enters the opening g^4, it forces the nail in the direction to the right in Fig. 31 out of the opening g^4. At the forward ends of the openings g^4 are spreading guides g^5 g^5, held normally together by leaf-springs g^{10} on the sides of the holders. (See Fig. 32.) The guides g^5 afford between them an opening g^{11}, just large enough to receive the shank of a nail to be driven, said opening being flared toward the opening g^4, whereby a nail as it passes from the latter opening is guided into the opening g^{11}, and thus positioned at the point in the driving operation. The driver passes through the opening g^4 and spreads apart the guides g^5 to force the head into the surface of the material to be nailed. In the bar I′ (see Figs. 19 and 20) are thumb-screws i^{14}, which register with the slots i^4. These thumb-screws may be screwed down to close the slots i^4. Thus when one or more of the nail-holders are out of use nails may be prevented from being fed thereto by screwing down the respective thumb-screws i^{14}. The tubes g^5 are made, preferably, of telescoping sections, so that the holders may be readily moved for the purpose of adjustment with reference to the bar I′.

Extending between the cheeks A' A^2 (see, for example, Fig. 27) are horizontal cross-bars A^{13} A^{13}, provided in their upper sides with T-slots f. M and M′ are outer braces or clenchers and M^2 an inner brace or clencher. (See, for example, Figs. 7 and 27.) The braces or clenchers are in effect anvil members and comprise upright blocks or plates provided with nut-bolts f', the heads of which slide in the T-slots f. The braces or clenchers may be moved laterally and secured in position by tightening the nuts on the nut-bolts f'. The braces M M′ are provided in their faces with shallow serrations f^2, forming clenching-surfaces, and the intermediate brace M^2 is provided toward the top with similar serrations f^2 for the same purpose. On the brace M^2 (see Figs. 7 and 27) is a spring-catch f^3, for a purpose hereinafter described, and which may be adjusted to any desired height on the brace; also, upon the brace M^2 is a downward-extending guide-rod f^4, which may be raised and lowered to adjust it to any desired height upon the brace. The braces M M′ M^2 collectively form an anvil, which takes the impact of the nail-drivers.

In the lower part of the machine and journaled at opposite ends in the cheeks A' A^2 is a shaft K^2 in nearly the

same plane as the shaft K. On the shaft K^2 are laterally-adjustable sprocket-wheels K^3 and on the shaft K are laterally-adjustable sprocket-wheels K^4. Extending over these sprocket-wheels are feed-chains K^5, each provided with box-end-engaging fingers K^6, disposed as shown. On the shaft K^2, is a sprocket-wheel K^7, which is geared to a sprocket-wheel F^8 on the shaft F by means of a drive-chain K^8.

N is a fly-frame on a rock-shaft N', which is journaled at opposite ends in the lower edges of the cheeks A' A^2. The fly-frame is similar to those used in printing-machines generally. On the shaft N', beyond the cheek A^2, is a disk N^2, eccentrically connected by means of a rod N^3 with the shaft D^2 on the ram D, as shown most plainly in Figs 2 and 9.

As a box end passes through the printing mechanism G it is deposited upon the fly-frame N, which latter is then in the position shown, for example, in Fig. 27. Fastened upon the fly-frame and adjustable laterally is a guide N^4, provided with clamps N^5, (see Fig. 6,) whereby it may be secured in any desired position. The guide N^4 is for the edge of the box end and operates to position it on the fly. The parts are so geared with relation to each other that when a box end has been deposited upon the fly the latter is swung to a vertical position, carrying the upper edge of the box end beneath the lower end of the guide-rod f^3 and the lower edge of the box end in the path of one set of fingers K^6 on the feed-chains K^5. The chains travel, moving the box end upward between the anvil and vertical guide-arms P until it passes at its lower edge the catch f^5 and is in position against the anvil for the nailing operation, as indicated in Fig. 34. The arms P press the end firmly against the anvil. The blank Z, which is to form the sides, top, and bottom of the box, as before mentioned, is then passed by the operator over the outer anvil members, whereby its cleats at one end extend over the edges of the box end. When this is done, the machine is started and nails are driven, as indicated in Figs. 31 and 32, and one box end thus fastened in place.

While the ram is moving backward after the driving operation, the operator lifts off the box, being assisted at that time by the rise of another box end into position, when he turns the box, slips it at its other end portion over the box [fol. 1400] end into position, and starts the machine again

to complete the box, as shown in Fig. 27. When the operator presses the blank Z down upon the box end, the stop f^5 holds the latter firmly in place, so that it will not yield downward under the pressure.

While I prefer to construct my improvements throughout substantially as shown, it is to be understood that the printing mechanism may be dispensed with, if desired, and that the mechanisms may be variously modified in the matter of details of construction without departing from the spirit of my invention as defined by the claims.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a box-nailing machine, the combination of a reciprocating ram, parallel series of nail-drivers mounted upon the ram, nail feeding and positioning devices, supported to cooperate with the nail-drivers, an anvil device having side faces against which the parts of the box are assembled and over which they are formed into the box shape, and having anvil-faces in line with the nail-drivers against which the corner edges of the box abut when the nails are driven, substantially as and for the purpose set forth.

2. In a box-nailing machine, the combination of a reciprocating ram, two parallel series and a cross series of nail-drivers mounted upon the ram, nail feeding and positioning devices supported to cooperate with the nail-drivers, an anvil device having side faces against which the parts of the box are assembled and over which they are formed into the box shape, and having anvil-faces, in line with the said parallel and cross series of nail-drivers, against which the corner edges of the box abut when the nails are driven, substantially as and for the purpose set forth.

3. In a box-nailing machine, the combination of a reciprocating ram, series of nail-drivers carried by the ram and relatively adjustable thereon to conform to and operate simultaneously against a plurality of box edges, nail feeding and positioning devices supported to cooperate with the said nail-drivers, an anvil device having side faces against which the parts of the box are assembled and over which they are formed into the box shape, and having anvil-faces, in line with the nail-drivers, against which the corner edges of the box abut when the nails are driven, substantially as and for the purpose set forth.

4. In a box-nailing machine, the combination of a reciprocating ram, series of nail-drivers carried by the ram and relatively adjustable thereon to conform to and operate simultaneously against a plurality of box edges, nail feeding and positioning devices, a support upon which said devices are mounted and upon which they are relatively adjustable to position them with relation to the nail-drivers, an anvil device formed of relatively adjustable members having side faces against which the parts of the box are assembled and over which they are formed into the box shape, and having anvil faces, in line with the nail-drivers, against which the corner edges of the box abut when the nails are driven, substantially as and for the purpose set forth.

5. In a box-nailing machine, the combination of a reciprocating ram, series of nail-drivers carried by the ram and relatively adjustable thereon to conform to and operate simultaneously against a plurality of box edges, nail feeding and positioning devices, a support upon which said devices are mounted and upon which they are relatively adjustable to position them with relation to the nail-drivers, an anvil device formed of relatively-adjustable members provided with serrated nail-clenching impact-faces, and forming a support having side faces against which the parts of the box are assembled and over which they are formed into the box shape, said impact-faces being in line with the nail-drivers and forming a support against which the corner edges of the box abut when the nails are driven, substantially as and for the purpose set forth.

6. In a box-nailing machine, the combination with the drive-shaft, of a ram operatively connected with the drive-shaft to be reciprocated thereby, nail-drivers carried by the ram, nail feeding and positioning devices supported to co-operate with the nail-drivers, an anvil device having side faces against which the parts of the box are assembled and over which they are formed into the box shape, and having anvil-faces, in line with the nail-drivers, against which the corner edges of the box abut when the nails are driven, means for positioning the box ends against the anvil device, comprising an endless carrier operatively geared to the said drive-shaft and provided with box-end engagers, and means for feeding the box ends to the carrier, substantially as and for the purpose set forth.

7. In a box-nailing machine, the combination with the drive-shaft, of a ram operatively connected with the drive-shaft to be reciprocated thereby, nail-drivers carried by the ram, nail feeding and positioning devices, a support upon which said devices are mounted and adjustable to position them with relation to the nail drivers, an anvil device, positioning mechanism for box ends between the nail-position devices and the anvil device, comprising an endless carrier operatively geared to the said drive-shaft and provided with box-end engaging means, and means for feeding box ends to the said carrier comprising an oscillating fly frame actuated from the drive shaft, substantially as and for the purpose set forth.

8. In a box nailing and printing machine, the combination with the drive-shaft, of a reciprocating ram operatively connected with the drive shaft, nail drivers carried by the [fols. 1401 & 1402] ram, nail feeding and positioning devices supported to cooperate with the nail drivers, an anvil device having side faces against which the parts of the box are assembled and over which they are formed into the box shape, and having anvil faces, in line with the nail drivers, against which the corner edges of the box abut when the nails are driven, movable box end engaging and positioning mechanism between the nail positioning devices and the anvil device, a box end printing device, means for feeding the box ends to the printing devices, and box end transferring mechanism movable between the printing device and the said box end positioning mechanism, all actuated from the said drive-shaft, substantially as and for the purpose set forth.

9. In a box nailing and printing machine, the combination with the drive-shaft, of a reciprocating ram operatively connected with the drive-shaft, nail-drivers, carried by the ram, nail feeding and positioning devices, a support upon which said devices are mounted and positioned with relation to the nail-drivers, an anvil device, movable box-end engaging and positioning mechanism between the nail-positioning devices and the anvil device, a box-end printing device comprising a printing cylinder, means for feeding box ends to and through the printing device, and a fly frame between the printing device and

the said box-end-positioning mechanism, all operatively connected with the drive-shaft, to operate substantially as and for the purpose set forth.

10. In a box nailing and printing machine, the combination with the drive-shaft, of a reciprocating ram operatively connected with the drive-shaft, nail-drivers carried by the ram, nail feeding and positioning devices, a support upon which said devices are mounted and positioned with relation to the nail-drivers, an anvil device, movable box-end engaging and positioning mechanism between the nail-positioning devices and the anvil device, a box-end-printing device comprising cylinders actuated from the drive-shaft through which the box ends pass, a support for box-ends, an endless carrier at said support actuated from the drive-shaft to feed the box-ends one at a time from the support to the printing device, and a fly frame actuated from the drive-shaft to receive the box ends from the printing device and move them to the said positioning mechanism, substantially as and for the purpose set forth.

11. In a box-nailing machine, the combination with the nail-drivers and nail-feeding and positioning devices supported to coöperate with the nail-drivers, of an anvil device having side faces against which the parts of the box are assembled and over which they are formed into the box shape, and having anvil-faces, in line with the nail-drivers, against which the corner edges of the box abut when the nails are driven, a box-end elevating and feeding carrier operating to move the box ends to the anvil device and discharge the box from the anvil device, and a resilient stop adjacent to the anvil upon which the box end rests in the nailing operation, substantially as and for the purpose set forth.

12. In a box-nailing machine, the combination with the main frame and constantly rotating drive-shaft, of a normally stationary counter-shaft parallel with the drive-shaft, a ram eccentrically geared to said counter-shaft, a gear-wheel normally loose upon the counter-shaft in mesh with a gear upon the drive shaft to rotate constantly, clutch mechanism between the counter-shaft and the rotating gear thereon, a second counter-shaft, a gear-wheel normally

loose upon said second counter-shaft and rotated constantly from the drive-shaft, clutch mechanism between the second counter-shaft and its gear, box and feeding and positioning mechanism operatively connected with the said counter-shaft, means for operating the clutch upon the first counter-shaft to cause said shaft to be rotated and released by the gear-wheel thereon, and trip mechanism in the path of the ram and operatively connected with the clutch upon the second counter-shaft to make and release engagement between the second counter-shaft and its gear wheel, all arranged to operate substantially as and for the purpose set forth.

Frederick P. Rosback.

In presence of J. H. Lee, R. T. Spencer.

(Here follow side folios 1403 1424.)

[fol. 1425] United States Patent Office

Frederick P. Rosback, of Chicago, Illinois, Assignor to William P. Healy, of Same Place.

Machine for Step-mitering and Printing Box-blanks.

Specification Forming Part of Letters Patent No. 609,630, Dated August 23, 1898.

Application filed December 7, 1897. Serial No. 661,030. (No model.)

To all whom it may concern:

Be it known that I, Frederick P. Rosback, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful improvement in Machines for Step-Mitering and Printing Box-Blanks, of which the following is a specification.

This invention relates to an improved machine for use more especially in the manufacture of a special box-blank which forms four sides of a wire-bound box or shipping-case. The box-blank when completed and ready to be formed into a box consists of a comparatively thin sheet of wood, wood fiber, or the like, in one length or two or more abutting sections, reinforced on one side with parallel lon-

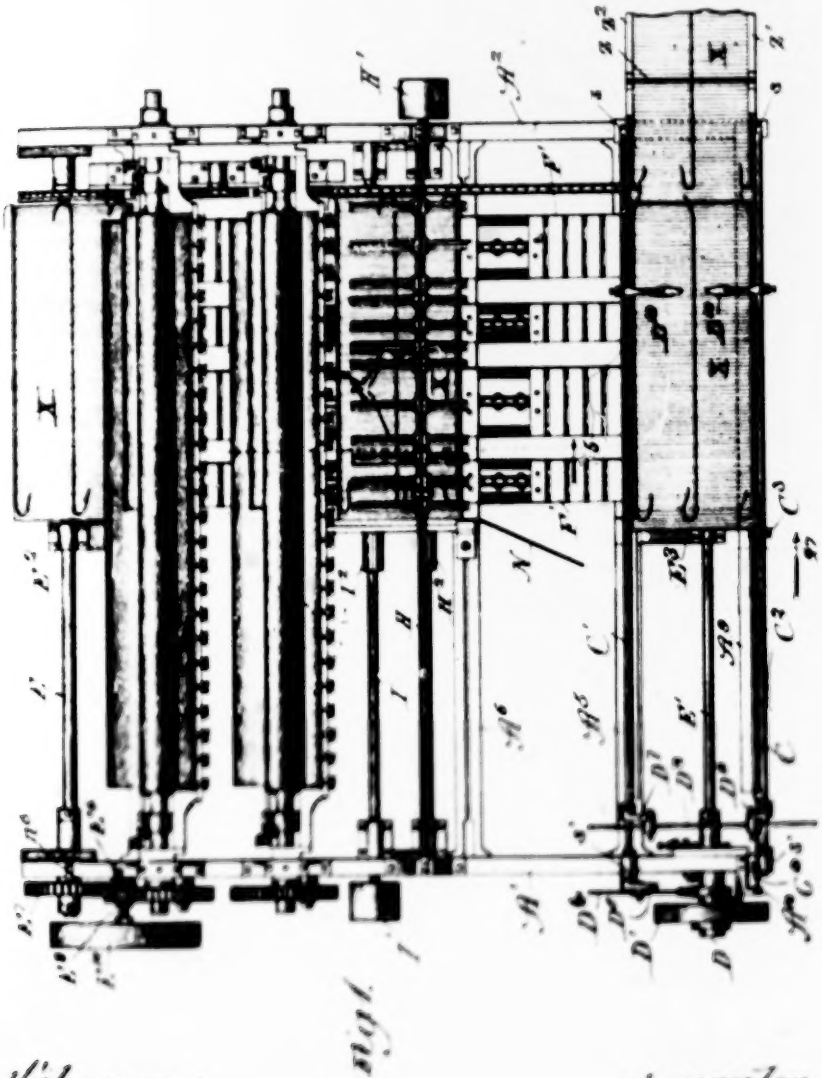
No. 609,630. Patented Aug. 23, 1898.

F. P. ROSBACK.

MACHINE FOR STEP MITERING AND PRINTING BOX BLANKS.

Application filed Dec. 7, 1897.

(No Model.) 11 Sheets—Sheet 1.



Witnesses:

Inventor.

1405-1406

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F. P. ROSBACK.

MACHINE FOR STEP MITERING AND PRINTING BOX BLANKS.

(Application filed Dec. 7, 1897.)

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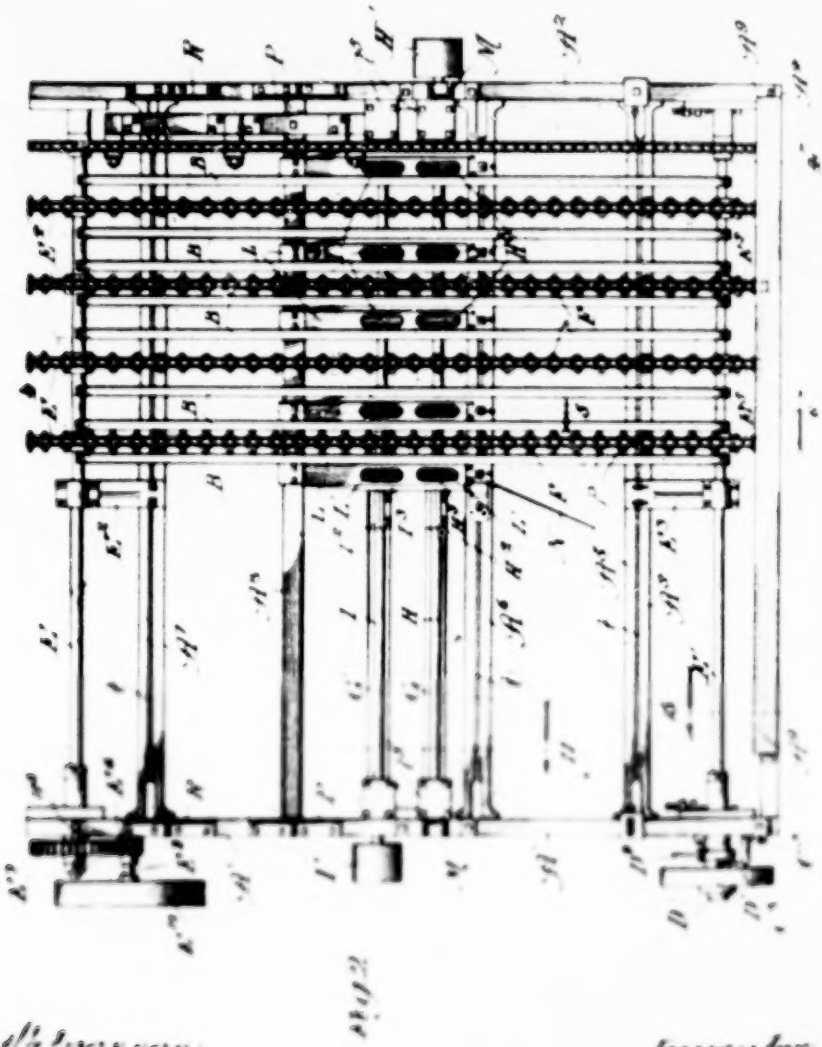

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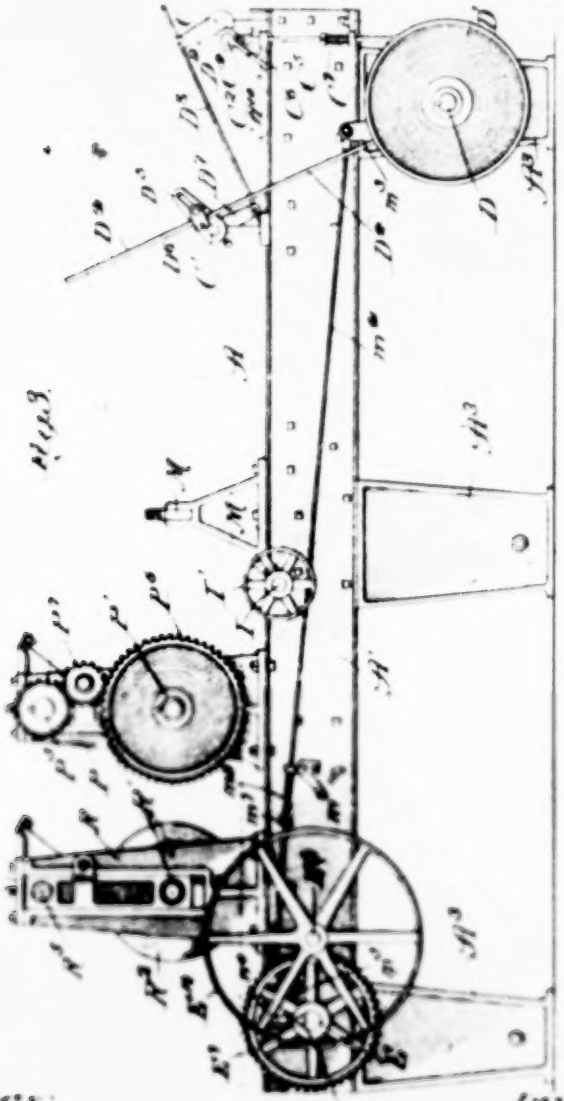
F. P. ROSBACK.

MACHINE FOR STEP MITERING AND PRINTING BOX BLANKS.

Application filed Dec. 7, 1897.

No Model. 8 Sheets—Sheet 3.



Witnesses:

Inventor.

1409-1410

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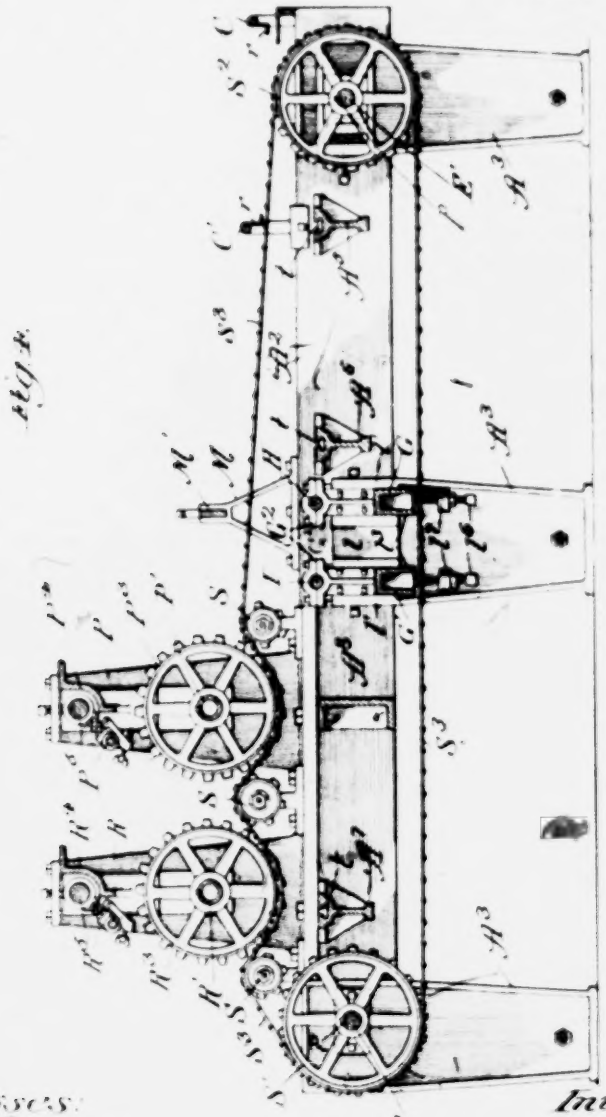
F. P. ROSBACK.

MACHINE FOR STEP MITERING AND PRINTING BOX BLANKS.

(Application filed Dec. 7, 1897.)

(No Model.) 8 Sheets—Sheet 4.



Witnesses:
Chas. C. Shepherd
Jule's S. Pike

Inventor
Frederick P. Rosback,
By Dyrenforth & Dyrenforth
Att'ys

1411-1412

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F. P. ROSBACK.

MACHINE FOR STEP MITERING AND PRINTING BOX BLANKS.

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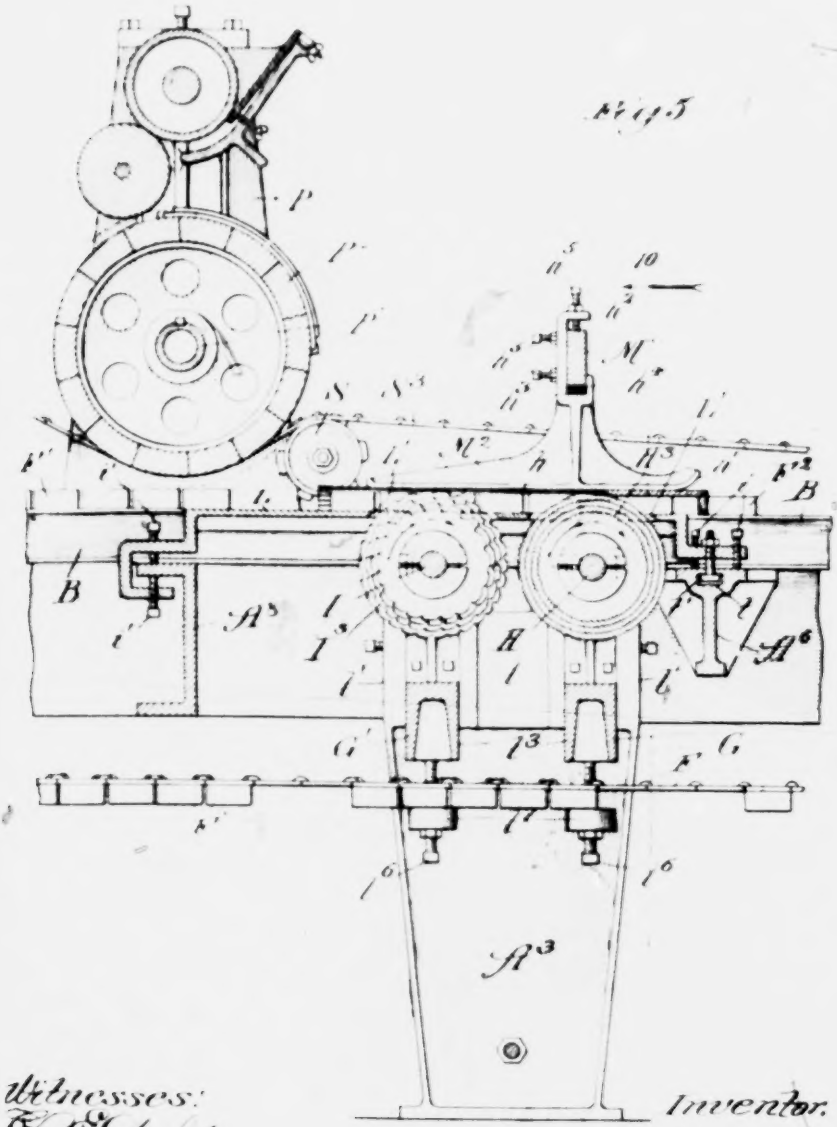
(No Model.) 11 Sheets—Sheet 5



Witnesses:
Chas. E. Taylor
Jule's S. Whi...

Inventor.
Frederick P. Rosback.
By Cyrus Bill & Cyrus Bill.
Attorneys.

1413-1414

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F. P. ROSBACK.

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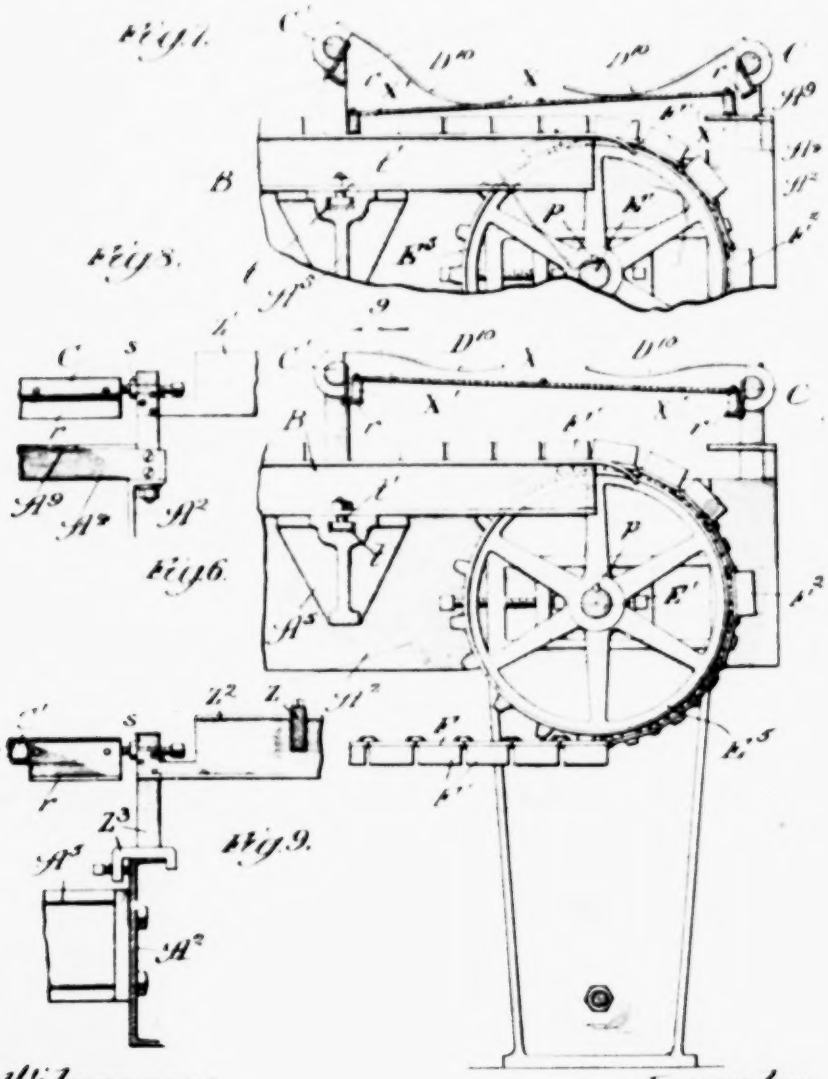
(No Model.) 8 Sheets—Sheet 6.



Witnesses:

Inventor.

Frederick P. Rosback,

By Dyrenforth & Dyrenforth,

Attys.

No. 609,630. Patented Aug. 23, 1898.

F. P. ROSBACK.

MACHINE FOR STEP MITERING AND PRINTING BOX BLANKS.

(Application filed Dec. 7, 1897.)

(No Model.) 8 Sheets—Sheet 7.

Fig. 10.

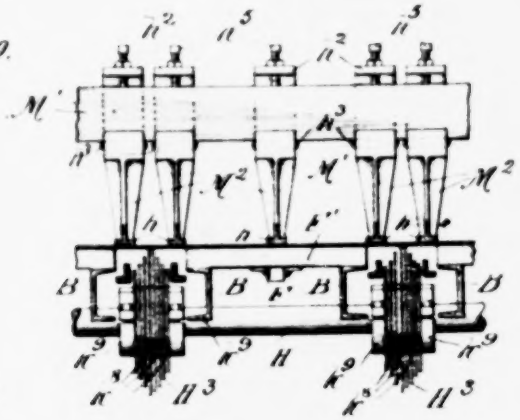


Fig. 11.

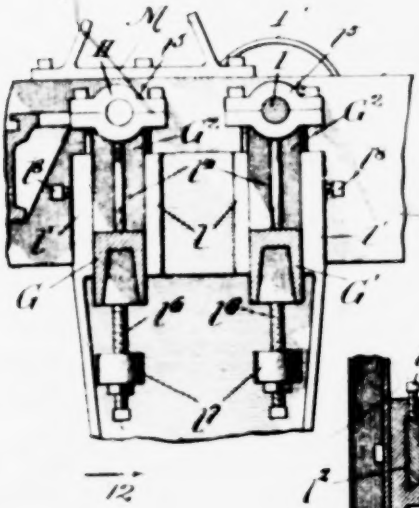


Fig. 12.

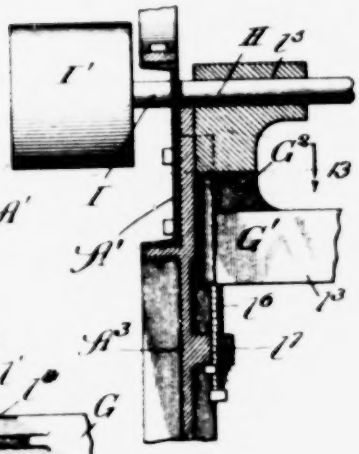
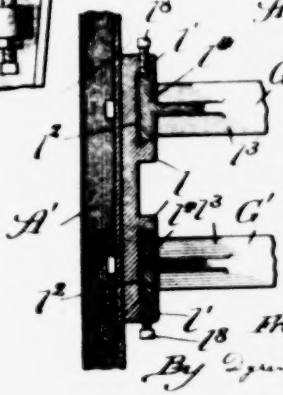


Fig. 13.



Witnesses:

Inventor:

Frederick P. Rosback.

By Dyrenforth & Dyrenforth

Attys.

1417-1418

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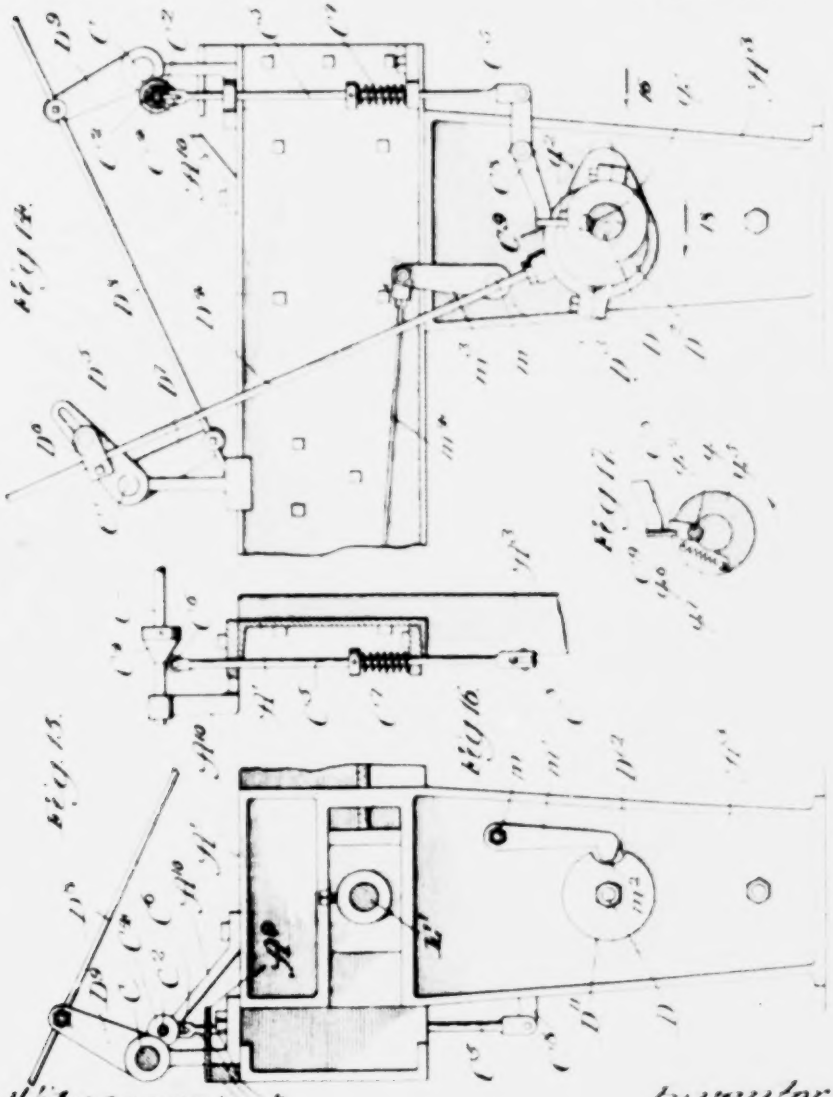
F. P. ROSBACK.

MACHINE FOR STEP MITERING AND PRINTING BOX BLANKS

Application filed Dec. 7, 1897.

(No Model.) 8 Sheets—Sheet 8.



Witnesses:

Inventor:

Frederick P. Rosback.

By Crawford & Crawford

Attorneys.

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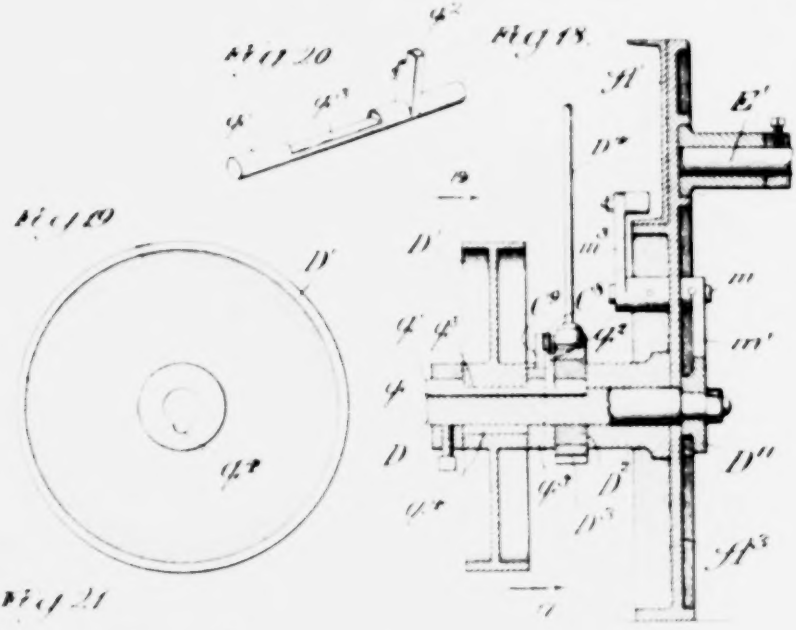
F. P. ROSBACK.

MACHINE FOR STEP MITERING AND PRINTING BOX BLANKS.

Application filed Dec. 7, 1897.

(No Model.) 8 Sheets—Sheet 8.



Witnesses:
Chas. F. Shepherd
Edw. J. Whe

Inventor:
Frederick P. Rosback.
By Shepherd & Shepherd
Attys.

1421-1422

No. 609,630 Patented Aug. 23, 1898

F. P. ROSBACK

MACHINE FOR STEP NOTCHING AND PRINTING BOX BLANKS

(No Model.) 9 Sheets-Sheet 6

Fig 23.

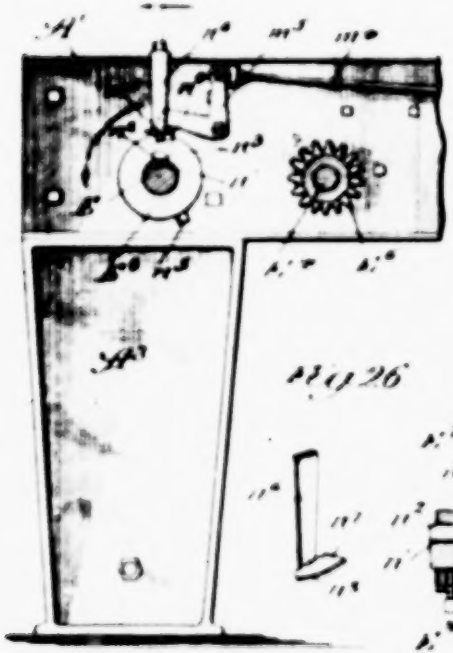


Fig 24.

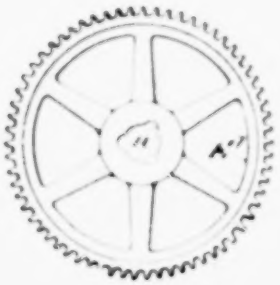


Fig 26.

Fig 25.

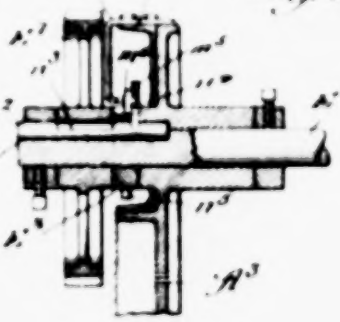
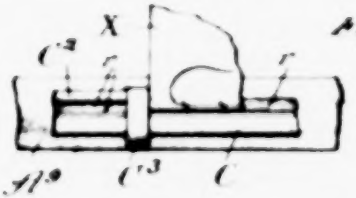


Fig 27.

Fig 28.



Witnesses

Inventor.

Frederick P. Rosback.

By Crosby & Crosby,

Attys.

No. 609,630 Patented Aug. 23, 1898.

F. P. ROSBACK.

MACHINE FOR STEP MITERING AND PRINTING BOX BLANKS.

(Application filed Dec. 7, 1897.)

(No Model.) 8 Sheets—Sheet 8.

Fig 29.

Fig 30.

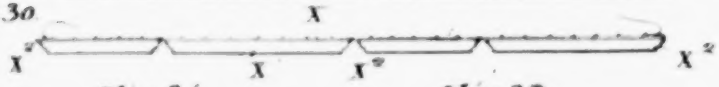


Fig 31.

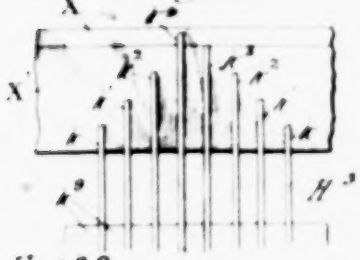


Fig 32.

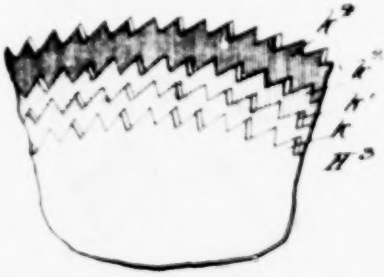


Fig 33.

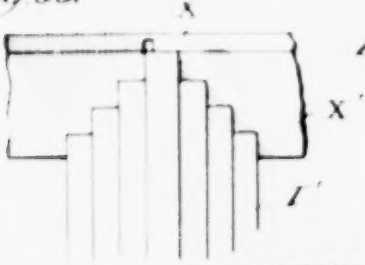
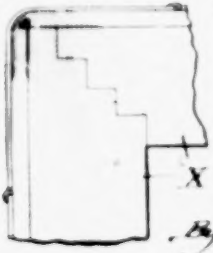


Fig 34.

Fig 35.



Witnesses:
Chas. E. Mayhall
Luke D. Wells

Inventor:
Frederick P. Rosback,
By [illegible]
Attys.

gitudinally extending cleats and at its opposite side with lengths of wire, the wires, sheet, and cleats being fastened together with staples or the like, driven at intervals to straddle the wires and pass through the sheet into the cleats. A top plan view of the blank is shown in Figure 29 of the drawings.

A machine for making the box blanks described is shown in application, Serial No. 613,574, filed November 27, 1896. The present machine is intended more especially to cooperate with the machine for making box blanks referred to, to produce step-mitered cuts in the cleats and in a surface of the sheet, and also trim the blank to the proper length, as illustrated, for example, in Fig. 30 of the accompanying drawings. The machine as I prefer to construct it is also provided with printing mechanism for printing advertisements in one or more colors upon the blanks. To form a box after the blank has passed through the present machine, the blank is bent at the step-mitered cuts to cause the latter to intermesh, as indicated, for example, in Fig. 33 of the present drawings, the blank forming the four sides of the box and ends being inserted and nailed to or resting against the cleats to complete the box. One end section of the blank forms a hinged cover for the box and may be fastened down by twisting together the ends of the reinforcing or strengthening wires, which are caused to extend beyond the ends of the blank for that purpose.

The present invention has nothing to do with the machine for forming the blanks or with inserting the ends and involves only mechanism for making the step-mitered cuts, trimming the blanks to proper length, and printing upon the blank.

It is to be understood that the invention is not limited to the use of printing mechanism.

In the drawings, Fig. 1 is a top plan view of the machine; Fig. 2, a plan section thereof taken on line 2 of Fig. 3; Fig. 3, a partly sectional side elevation of the machine; Fig. 4, a longitudinal section taken on line 4 of Fig. 2 and viewed in the direction of the arrow; Figs. 5 and 6, enlarged broken sections taken on lines 5 and 6 of Fig. 2; Fig. 7, a broken view of the mechanism shown in Fig. 6 and illustrating with the latter figure the manner of feeding a blank to the machine; Fig. 8, a broken elevation of a portion of the front

disks; and Fig. 13, an enlarged broken view of the corner of a completed box, showing how the blank is bent to produce the corner.

The machine is so located with reference to the machine for making the box blanks above referred to that as the blanks X are discharged from the latter they are pushed one by another into the present machine, being fed, as illustrated in the lower right hand corner portion of Fig. 1, across the under side of a cross-bar Z, which turns back the forward free ends of the wires, as shown. When a blank is in position, it strikes a trip. The two larger pulleys shown to the left in Fig. 1 are belted to a suitable drive shaft, whereby they revolve constantly but loosely upon the shafts on which they are mounted. When a blank engages the trip, the latter operates a clutch mechanism, which starts feed chains and cross-fingers to press the blank downward onto the feed chains. The feed chains move the blank backward across the slotting saws and beneath the printing rollers.

A is the frame of the machine, formed with side bars A', A, mounted upon legs A, a front bar A', and stationary cross-joists A A A A. The joists A A' A are provided on their upper surfaces with longitudinally extending T slots or recesses t, as shown. Resting upon the joists are parallel guide bars B, extending from near the front nearly to the rear end of the machine. The guide bars are adjustable toward and away from each other, so that blanks of any size up to the capacity of the machine may be guided, as hereinafter described. The bars B are held in place when adjusted by means of bolts t', (see Figs. 6 and 7,) which pass through flanges on the bars and rest at their heads in the T slots t. To adjust the bars, the nuts upon the bolts are loosened, and they are then slid laterally along the joists and secured again by tightening the nuts.

Extending along the front of the machine on the front bar A' is a stationary shelf A'. C' and C'' are rock-shafts journaled at one end in suitable bearings s on the side bar A', as shown most plainly in Figs. 8 and 9, and journaled at their opposite ends in bearings s' s' on the side bar A'. On the rock-shafts are downward and inward extending guides c c, upon which the blank X rests and slides as it is pushed initially into the machine. Journaled in a bearing in the

which in practice is belted to a suitable drive-shaft. (Not shown.) In the shaft D (see, for example, Fig. 18) is a groove or recess q, and resting in the said recess is a rocking pin q', (see Fig. 20,) having an arm q^2 and a cut-away portion q^3. The cut away portion q^3 is of a length equal to the width of the pulley D', and in the inner periphery of the hub of the said pulley is a recess q^4. When the pin q' is rocked to one position, the pulley turns loosely upon the shaft D in the cut away portion q of the pin. When the pin q' is rocked axially to a position whereby the metal adjacent to the cut-away portion or recess will project into the recess q^4, the pulley is locked to the shaft and the shaft will be rotated by the pulley. Thus the pin q' operates as a clutch to produce engagement and disengagement between the pulley and shaft.

Extending parallel with the rock-shaft C is a thrust-rod C^2, secured at one end to a sliding bearing-hook C^3, (see Fig. 27,) which rests upon the shaft C at the point shown in Fig. 1, and passing at its opposite end through an opening in a bearing-bracket A^{10} on the side bar A'. In the location shown most plainly in Fig. 1 the thrust-rod carries a cone C^4. (See Fig. 15.) Extending through bearing openings in the side bar A' is a vertical rod C^5, provided at its upper end with an anti-friction wheel C^6, which rides on the thrust-rod C^2 at the cone C^4. The rod is pressed upward by a confined spring C^7, as shown in Figs. 14 and 15.

C^8 is a lever pivoted between its ends against the leg A^3 and pivotally connected at its outer end with the lower end of the rod C^5, as shown in Fig. 14. On the opposite end of the lever C^8 is a head or lip C^9.

On the shaft D is a collar q^5, provided with a radial recess q^6, through which the arm q^2 of the pin q' projects. A spring q^7 in the recess and connected at one end with the collar and at its opposite end with the arm q^2 tends normally to turn the pin q' on its axis to the position wherein it locks the shaft to the pulley. At its outer end the arm q^2 projects slightly beyond the circumference of the collar q^5 into the path of the lip C^9, which rides upon the collar. In operation when a blank X slides along the guides r and strikes the stop-piece C^{12} the latter is moved and moves the thrust-rod C^2, causing the cone C^4 to slide upon the [fol. 1427] antifriction-wheel C^6 and move the rod C^5 downward against the resistance of the spring C^7. This

downward movement of the rod C^5 turns the lever C^6 and raises the lip C^{10} out of engagement with the arm q^2. This release of the arm q^2 causes it to be swung by the spring q^3 to turn the pin q' axially, whereby it will engage the groove q^4 in the pulley and lock the pulley and shaft together. On the shaft D is an eccentric D^2, surrounded by an eccentric-ring D^3, from which extends a rod D^4. On the rock-shaft C' is an arm D^5, provided with a longitudinally-extending slot, and adjacent to the said arm is a block D^6, having a lateral extending pin which slides in the slot of the said arm. The block D^6 is adjustably secured to the rod D^4; also, upon the rock-shaft C'' is a downward-extending arm D^7, from which extends a rod D^8 to an upwardly-extending arm D^9, fastened to the rock-shaft C. On the rock-shafts C' C'', in the positions shown, for example, in Fig. 1, are inwardly-projecting spring fingers D^{10}. Normally the fingers extend in the plane indicated in Fig. 6. When a blank X strikes the stop C^3 and causes the shaft D to be clutched by the pulley D', the eccentric D^2 is turned to pull down and then raise the rod D^4. In the descent of the said rod the shaft C'' is rocked to swing its finger D^{10} in the downward direction, and through the connection D^7 D^8 D^9 the shaft C' is rocked to swing its finger D^{10} in the downward direction. The fingers D^{10} bear upon the upper surface of the blank X, moving the latter downward from the position shown in Fig. 6 to that shown in Fig. 7. Thus the blank is released from the stop C^3, causing the spring C^7 to raise the rod C^5 to move the rod C^2 to its initial position and at the same time swing the lip C^{10} down against the surface of the collar q^5. By this means the lip C^{10} engages the arm q^2 as the shaft is about to complete one revolution and draws it to the position shown in Fig. 17, whereby the pin q' is rocked out of engagement with the pulley and the shaft stops at the end of one revolution.

E is a shaft at the rear end of the machine, journaled at opposite ends in bearings in the side bars A^1 A^2, and E' is a companion shaft toward the front of the machine, also journaled at opposite ends in the said side bars.

E^2 is a stay removably fastened to the joist A^7 and at its free end forming a bearing for the shaft E between the ends of the latter. E^3 is a similar stay fastened to the joist A^8 and forming a bearing through which the shaft E' passes. The stays E^2 E^3 are provided to steady the shafts

and are required on account of the length of the latter. The said shafts are provided with key-ways, as shown, for example, in Figs. 4, 6, and 7. On the shaft E are sprocket-wheels E^2, fastened with removable keys p to revolve therewith. On the shaft E' are sprocket-wheels E^4, coinciding in position with the sprockets E^2 and fastened in the same way. Extending over companion sprocket-wheels E^2 E^4 are feed-chains F, formed as shown most plainly in Figs. 21 and 22. Every second link of each feed-chain is formed with laterally extending ears p', having screw-holes p^2. At their upper sides the feed-chains run between guide-bars B, the tops of the chains being in the planes of the upper surfaces of said bars.

F' F'' are series of feed-blocks, which may be of wood, the first and last block of each series being fastened to the upper side of a link of a chain F with screws passing through the screw-opening p^2 into the blocks. The intermediate blocks F'' are provided on their under surfaces, as shown in Fig. 22, with bowed spring-catches p^3, which when sprung into the links hold the blocks to the chain. The blocks are of a length which cause them to ride or slide upon the guide-bars B and are of a thickness approximating the thickness of the cleats X' (see Fig. 30) of the blank X. A series of blocks consists of a sufficient number to form a length nearly, but not quite, equal to the distance between the cleats X' of a blank, as indicated most clearly in Figs. 6 and 7. Journaled in the side bar A' near the shaft E is a short shaft E^5, carrying a pulley E^{10} and a pinion E^6. The pulley E^{10} is belted to a suitable driving power, whereby it, the shaft E^5, and pinion E^6 revolve constantly. On the shaft E beyond the side bar A' is a gear-wheel E^7. (See Figs. 1, 2, 3, 24, and 25.) In the bearing-opening of the gear-wheel E^7 are three recesses u. (Shown in Fig. 24.) In the end of the shaft E (see Figs. 23 and 25) is a recess u', in which is located a rocking pin u^2, having a recess u^3 in one side of a length equal to the width of the hub of the wheel E^7. The pin u' is of the same form and performs the same function as the rocking-pin q'. (Shown in Fig. 20 and before described.) On the pin is an arm u^4 substantially like the arm q^2 on the pin q'. On the shaft E and revolving therewith is a collar E^8, having a radial recess through which the arm u^4 projects. The col-

lar E^5 is substantially like the collar q^5, before described, and arm u^4 is connected with the collar by a spring, the construction being the same as that shown in Fig. 17 and before described, whereby the spring tends normally to rock the pin u, so that it will lock the shaft to the constantly-rotating gear-wheel E^7. The collar E^5 differs from the collar q^5 in that it carries a projecting cam u^5. Fastened against the side bar A' and extending downward close to the collar E^5 is a spring-finger u^6, carrying an offset or shelf u^7, provided with a cam edge u^8. (See Fig. 26.)

On the inner side of the leg A^3 at the front of the machine and mounted upon the shaft D is a disk D^4, having a notch D^5 in its periphery. Journaled in the leg and passing through the latter is a short rock-shaft m, (see Figs. 15 and 18,) having on the inner side of the leg a downward-[fol. 1428] extending arm m', provided with a toe m^2, which rides upon the circumference of the disk D^4 and enters the notch D^5. On the opposite side of the said leg A^3 and fixed upon the shaft m is an arm or lever m^3, from the free end of which extends a rod m^4 to a bell-crank lever m^5, (see Fig. 23,) fulcrumed toward the rear end of the bar A'. The lever m^5 carries a laterally-extending lip m^6, which rides upon the circumference of the collar E^5 and engages the projecting end of the arm u^4.

In the rotation of the shaft D, as before described, the disk D^4 is turned and swings the arm m' by forcing the toe m^2 out of the recess D^5, whereby the toe rides upon the circumference of the disk D^4. The swinging of the arm m' rocks the shaft m and turns the arm m^3 in the direction of drawing upon the rod m^4, whereby it swings the bell-crank lever m^5 to disengage the arm u^4 of the rocking pin u^2. The spring corresponding with spring q^7, as before mentioned, draws the arm u^4 over to rock the pin u^2 on its axis and locks the shaft E to the gear-wheel E^7 by engaging one of the recesses u in the latter. Thus the shaft E will rotate with the gear-wheel E^7. The cam-offset u^7 at the lower end of the spring-finger u^6 presses against the laterally-extending lip m^6 on the lever m^5, so that when the said lip is raised the part u^7 of the spring-finger springs beneath it and holds it in a raised position. In the rotation of the shaft E and collar E^5 the cam u^5 engages the cam-surface u^8 of the spring-finger. On the rod m^4 and confined between a

collar m^3 thereon (see Fig. 3) and a stop m^4 on the side bar bar A' is a spring m^5, which tends to thrust the rod m^2 in the direction from right to left in Fig. 3. When the cam n^2 engages the cam edge n^3 on the spring finger n, it moves the offset n^4 out of engagement with the bell-crank lever, whereby the lip m^6 on the latter is pressed down upon the circumferential face of the collar F^3. Thus when the shaft E and attendant parts have nearly completed one revolution the arm n' of the rocking pin is engaged by the lip m^6 and the shaft E unlocked from the gear wheel E^2 just as one revolution is completed. The turning of the shaft E one revolution, as described, causes the sprocket-wheels E^3, feeding chains F, blocks F^2, and sprocket wheels E to be moved. Just before starting one series of feed-blocks F' are in the position indicated in Fig. 7, so that when a blank X is pressed down, as before described, to the position there shown the forward block of the series engages the cleat X' and the blank is moved laterally into the machine. Following each series of blocks F' is a single block F^2, also secured to the feed-chain, which engages the other cleat X^2. It will be understood that the blocks are so positioned upon the feed-chains that they will engage the cleats of a blank of the size being manufactured. Thus while the first and last blocks engage the cleats the sheet or web of the blank rests firmly at its under surface upon the surfaces of the intervening blocks, which form a solid bed therefor.

On the inner sides of the intermediate legs A^3 and side bars A' A^4 are vertical guides I I', forming at the said side bars coincident pairs of vertical dovetailed guide sockets I^2, as shown most plainly in Fig. 13. G G' are frames each consisting of a cross-bar I^3 with a vertical journal-box G^2 at each end. Each journal-box comprises a vertical plate I^4, which slides in a vertical guide I^5, and a removable and replaceable bearing-cap I^6. The frames G G' are thus mounted at opposite ends in the vertical dovetailed guide-recesses I^2 and rest at opposite ends on adjusting-screws I^7, which pass through lugs I^8 I^8 on the inner faces of the intermediate legs A^3. The frames may be raised and lowered by turning the screws I^7, and when adjusted as to height they are secured in place by means of set-screws I^9.

which pass through the guides l' and are tightened against the vertical plate portions l^4 of the frames.

Journaled in the journal-boxes G^2 of the frames, respectively, are shafts H I. The shaft H, beyond the side bar A^2, carries a belt-pulley H, and the shaft I, beyond the side bar A', carries a belt-pulley I'. The pulleys H' I' are belted to a suitable drive-shaft to rotate constantly. Between the ends of the shafts I H are stays I^2 H^2, adjustably fastened to the bars l^3 and loosely embracing the shafts to steady them. On the shaft H are clusters H^3 of saws of the form shown in Figs. 31 and 32. Each cluster H^3 consists of eight saw-disks, the two outer ones k being of the same diameter, the two next inner ones k' being of slightly greater diameter, the two next ones k^2 being of still greater diameter, and the two central ones $k^3 k^3$ being one of slightly-larger diameter than the other and both of larger diameter than the saws k^2. The saw clusters H^3 are intended to produce the initial saw-cuts for step-mitering the blanks and engage the blank, as indicated most plainly in Fig. 31. The saw-disks are separated from each other by means of spacing-collars k^4, as shown in Fig. 10, and are clamped between collars k^5 on the shaft H. The collars k^5 are split and held together with bolts, whereby they may be readily removed from the shaft H and permit adjustment of the clusters along the shaft for the purpose of positioning them. On the shaft I, coincident with the clusters H^3, are clusters I^3 of chipping-disks, consisting of seven toothed disks which attack the blank, as shown in Fig. 33, to chip out the wood between the cuts produced by the clusters H^3 and produce step-miters X^2, as shown in Fig. 30.

Fastened upon the cross-joists A^6 A^7, at each pair of saw clusters H^3 I^3, is a bed-plate L, each having a pair of [fol. 1429] elongated opening L' L', through which the saw clusters project, as shown most plainly in Fig. 5. The bed-plates L are shaped longitudinally, as shown in Fig. 5, to extend at one end flatwise over the joist A^6 and at its opposite end to extend over and under the flange of the cross-joist A^7. At the joist A^6 the bed-plates are fastened down by means of bolts t', being positioned as to height by means of set-screws i. The bed-plates are secured to the joists A^8 by means of set-screws i', one of which bears

against the upper side of the flange of the joist and the other against the under side.

On the side bars A' A^2 in the positions shown are coincident upward-extending brackets M.

M' is a bar fastened at opposite ends in the brackets M.

M^2 M^2 are presser-feet, of which twelve are employed in the present machine, as shown in Fig. 1. They are all constructed alike and as shown most plainly in Figs. 5 and 10. Each has a long and narrow forward and backward extending foot portion, presenting a smooth under surface h, with an upwardly-curved forward end h'. The upper portion of each presser-foot is provided with a flange h^2 to extend over the bar M' and a socket h^3 to receive the lower edge of said bar. In the socket h^3 of each foot is a cushioning-block h^4, of the rubber or the like, and the feet are fastened to the bar M' by means of set-screws h^5.

In operation when the blank X is deposited upon the carriers F', as shown in Fig. 7, it is moved laterally in the backward direction a distance equal to the circumference of the sprocket-wheels E' E^2, which carries it to the position shown in Fig. 5. In the next following revolution of the sprocket-wheels, brought about as before stated, the blank is carried backward to the rear end of the machine. In the backward movement of the blank from the position shown in Fig. 7 it passes beneath the presser feet M^2 and is operated upon first by the saw clusters H^2 and then by the saw clusters I^2, whereby the step-miter cuts are formed in the cleats, and cuts are produced by the central saws k' in the under side of the sheet. The presser-feet operate to hold the blank firmly down upon the feed-blocks F' and in sliding contact with the bed-plates L. In the position shown in Figs. 1 and 2 is a slanting guide N. When the blank is first deposited upon the feed-blocks F', it is at a point slightly beyond the position it should occupy in moving across the saws. As it is moved in the backward position from the position shown in Fig. 1 the end of the blank strikes the guide N and is positioned thereby to cause the cuts to be formed at the proper points in its movement across the saws.

As before stated, it is desirable to print advertisements upon the blanks to appear on the outer surfaces of the boxes when they are formed. In order that the printing may be

performed in one or two colors, the two printing mechanisms to be next described are provided.

Mounted upon the side bars A' A^2 are forward cheeks or standards P and rear cheeks or standards R. Journaled in the standards P is a shaft P', carrying a cylinder P^2, forming a printing cylinder or bed, upon which a printing-form may be secured in any desirable way. On the shaft P', adjacent to the side bar A^2, is a sprocket-wheel P^3. Above the cylinder P^2 is an ink-trough P^4 and ink-rollers P^5, which transfer ink from the trough to the form on the cylinder. The cylinder-shaft carries a gear P^6, and the rollers have pinions P^7, (see Fig. 3,) whereby the rollers are rotated from the cylinder-shaft. Journaled in the standards R is a shaft R', carrying a printing-cylinder R^2 and sprocket-wheel R^3. Above the cylinder R^2 is an ink-trough R^4 and ink-rollers R^5, geared like the rollers P^5 to the cylinder-shaft, which transfer ink from the trough to the form on the cylinder R^2. Mounted in standards on the side bar A^2 are idle sprocket-pinions S, as shown in Fig. 4. On the shaft E is a sprocket-wheel S' in line with the sprocket-wheels R^3 P^3 and sprocket-pinions S, and on the shaft E' is a sprocket-wheel S^2 in line with the other sprocket-wheels mentioned. A drive-chain S^3 extends around the sprocket-wheels S' S^2, over the idlers S, and under the sprocket-wheels R^3 P^3. Each time the shaft E is rotated as before described the printing-cylinders are given one complete revolution, whereby a blank as it is fed beneath them after passing the saws is printed by the forms on the cylinders.

It will be understood from the above description that in two intermittent revolutions of the shaft E, brought about as before stated, a box-blank is step-mitered and printed ready to be folded at the step-miter cuts, as indicated in Fig. 35, to form the four sides of a box.

When the blanks are initially pushed into the machine, they move between lateral guides Z' Z^2, which lead to the upsetting-guides r. The shaft C' and attendant parts and the guide Z^2 are supported in shifting brackets Z^3, (see Fig. 9,) which may be moved along the side bars and adjusted to accommodate blanks of any width within the capacity of the machine. As a blank is moved in the guides Z' Z^2, with the wires X^3 extending as shown in Fig. 29, the for-

ward ends of the wires are engaged by the bar Z and turned back, as shown in Fig. 1. Then when the blank is lowered onto the feed-chains F the next blank while passing over its end engages and turns back the wires at the opposite ends. This is important because it bends the wires at the ends out of the way of the end saw clusters.

While it is preferred to construct the machine throughout as shown and described, it may of course be modified in the matter of details of construction without departing from the spirit of the invention as defined by the claims. [fol. 1430] What is claimed as new, and desired to be secured by Letters Patent, is—

1. In a step-mitering machine, the combination with the feeding mechanism for the material to be step-mitered operating to advance the material sidewise as regards its grain, of rotating initial cutting saws, in the path of the material as it is fed, operating to produce the side cuts of the steps across the grain of the material, and rotating chipping-disks in the path of the material beyond said saws operating to chip out the material between the side cuts to produce the steps, substantially as described.

2. In a step-mitering machine, the combination with the feeding mechanism for the material to be step-mitered operating to advance the material sidewise as regards its grain, of a rotating saw cluster H, in the path of the material as it is fed, operating to produce the side cuts of the steps across the grain of the material, and a rotating cluster I of chipping-disks in the path of the material beyond said saw cluster operating to chip out the material between the side cuts to produce the steps, substantially as described.

3. In a step-mitering machine, the combination with the feeding mechanism for the material to be step-mitered operating to advance the material sidewise as regards its grain, of a rotating shaft carrying a series of initial-cutting-saw clusters in the path of the material as it is fed to produce the side cuts of the steps across the grain of the material, and a rotating shaft carrying a series of chipping-disk clusters in the path of the material beyond said saw clusters operating to chip out the material be-

tween the side cuts to produce the steps, substantially as described.

4. In a step-mitering machine the combination with the feeding mechanism for the material to be step-mitered operating to advance the material sidewise as regards its grain, of a rotating shaft carrying initial-cutting-saw clusters adjustable toward and away from each other and in the path of the material as it is fed to produce the side cuts of the steps across the grain of the material, and a shaft carrying clusters of chipping-disks adjustable toward and away from each other and in the path of the material beyond said saw clusters operating to chip out the material between the side cuts to produce the steps, substantially as described.

5. In a step-mitering and printing machine, the combination with the feeding mechanism for the material to be step-mitered and printed operating to advance the material sidewise as regards its grain, of step-mitering mechanism in the path of the material as it is fed comprising rotating initial cutting-saws and rotating chipping-disks beyond said saws, and a printing-cylinder in position to print upon the material as it passes through the machine, substantially as described.

6. In a step-mitering and printing machine, the combination with the feeding mechanism for the material to be step-mitered operating to advance the material sidewise as regards its grain, of rotating initial cutting-saws in the path of the material as it is fed operating to produce the side cuts of the steps across the grain of the material, rotating chipping-disks in the path of the material beyond said saws operating to chip out the material between the side cuts to produce the steps, and a printing-cylinder beyond the said chipping-disks and operating to print upon the material as it passes to the end of the machine, substantially as described.

7. In a step-mitering machine, the combination of intermittent feed mechanism for the material to be step-mitered, a guide for the material, extending crosswise of and over the initial end portion of said feed mechanism, through which the material is advanced laterally into the machine,

trip mechanism at said guide in the path of said material, means for depressing said material and transferring it from said guide to the feed mechanism, means for starting the feed mechanism and transferring mechanism actuated by the trip mechanism through contact with the latter of the said material, and rotating step-mitering disks in the path of the material as it is fed by said feed mechanism, substantially as described.

8. In a machine for step-mitering a box-blank, which consists of a sheet reinforced on one side with cleats, means for advancing the blanks through the machine comprising movable endless chains and feed-blocks on the chains adapted to engage the cleats and form a bed with which the sheet rests in contact, and rotating step-mitering disks in the path of the material, substantially as described.

9. In a machine for step-mitering box-blanks, the combination with the rotating shafts carrying the step-mitering disks, of shafts E E' normally stationary, sprocket-wheels on said shafts, feed-chains on said sprocket-wheels, provided with means for engaging and moving the blanks across the step-mitering disks, rotating means for the shafts E E', normally out of engagement therewith, a guide, through which the blanks are advanced into the machine from one side thereof, extending crosswise of and over one end of said feed-chains, means for depressing and transferring the blanks from the guide to the feed-chains, clutch mechanism operating to produce engagement between said shafts and their rotating means, and trip mechanism at said guide in the path of the blanks operatively connected with said transferring and clutch mechanisms, substantially as and for the purpose set forth.

10. The combination of the upsetting-guides *r*, traveling feed F, blank engaging and depressing fingers D'' and trip mechanism in the path of the blanks as they are ad- [fols. 1431 & 1432] vanced into the machine operatively connected with said guides and fingers, substantially as and for the purpose set forth.

11. In a machine for step-mitering box-blanks provided with cleats on one side and reinforcing-wires on the opposite side having projecting ends, the combination with

No. 614,348 Patented Nov. 15, 1898

F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS

Application filed June 20, 1898.

No Model. 9 Sheets—Sheet 1.

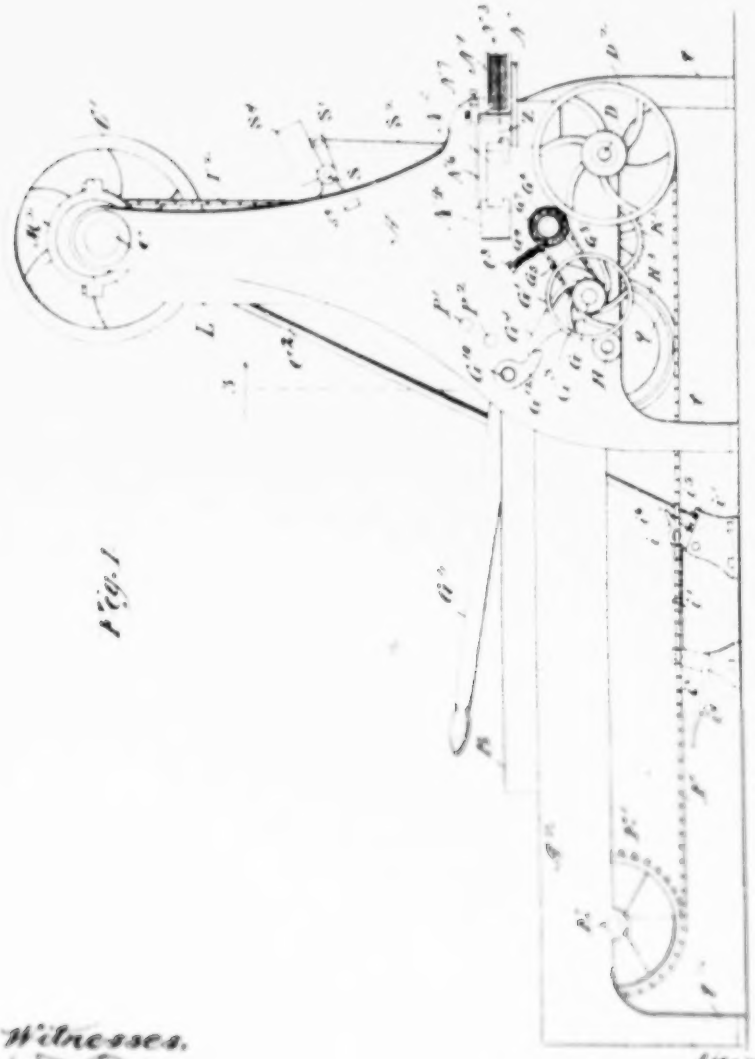


Fig. 1.

Witnesses.

Inventor:

Frederick P. Rosback,

By [illegible] Agent.

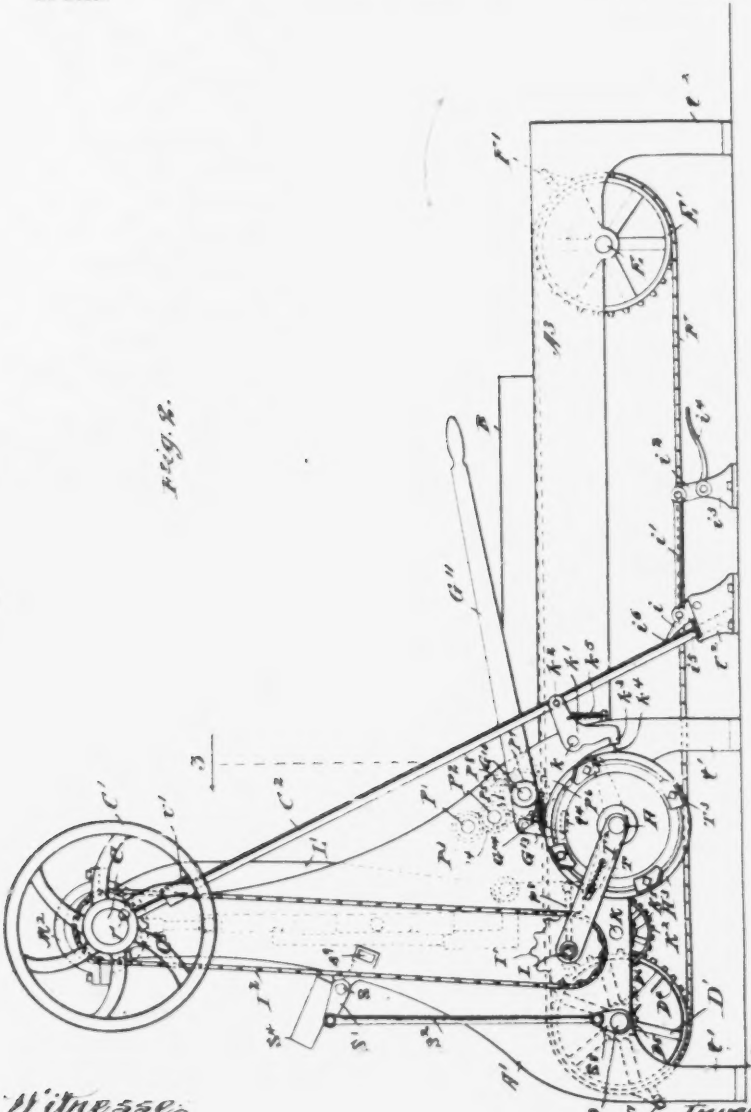
No. 614,348. Patented Nov. 15, 1898.

F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS.

Application filed June 20, 1898.

No Model. 9 Sheets—Sheet 2.



Witnesses:
D. Mann,
F. G. Spencer.

Inventor,
Frederick P. Rosback.
By Dyrenforth & Dyrenforth,
Att'ys.

No. 614,348. Patented Nov. 15, 1898.

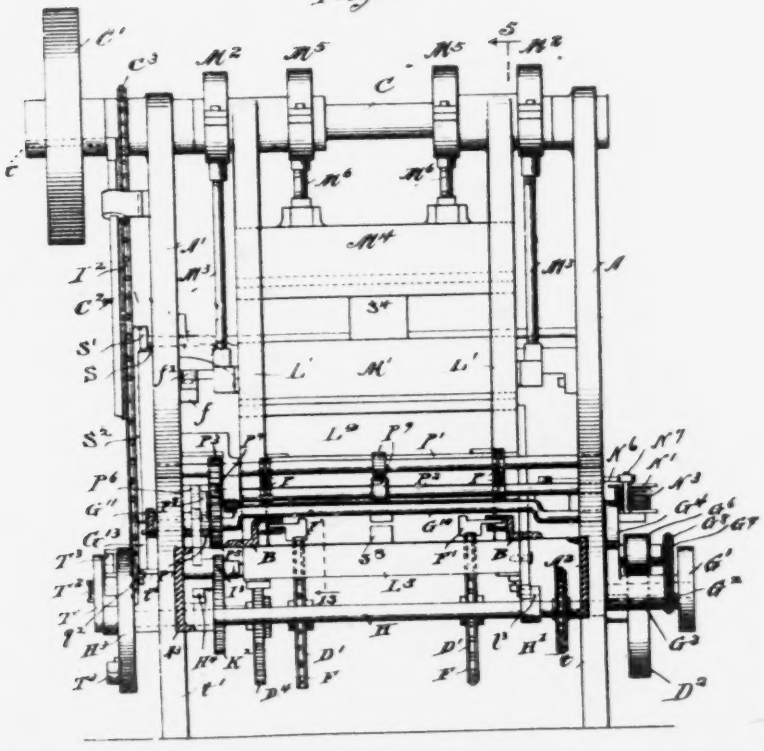
F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS.

(Application filed June 20, 1898.)

(No Model.) 9 Sheets—Sheet 3.

Fig. 3.



Witnesses,
W. B. Mann
R. D. Spencer

Inventor,
Frederick P. Rosback,
By Dyrenforth & Dyrenforth,
Attys

1439-1440

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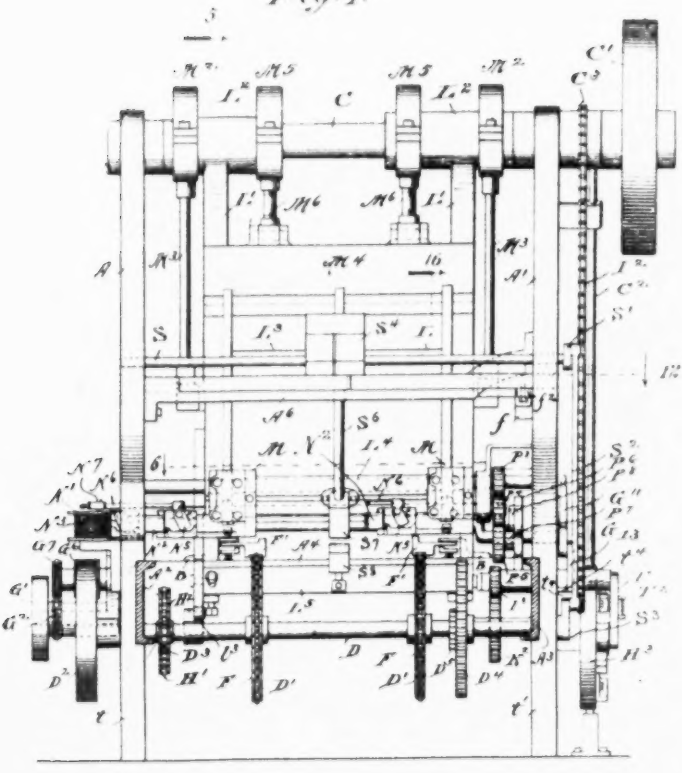
F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS.

Application filed June 20, 1898.

No Model. 9 Sheets—Sheet 4.

Fig. 4.



Witnesses.

Inventor

Frederick P. Rosback.

By Lyon & Lyon

Attys.

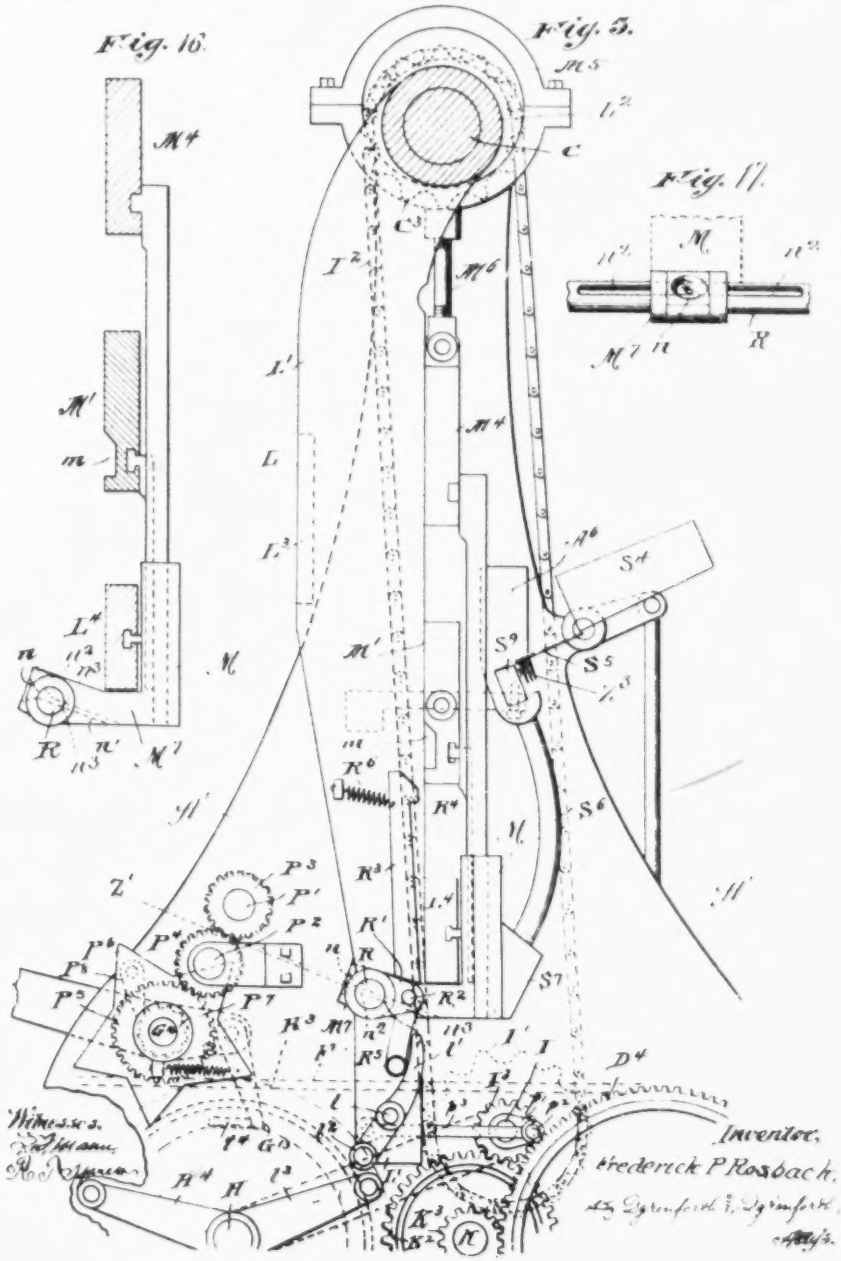
No. 614,348. Patented Nov. 15, 1898.

F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS.

Application filed June 20, 1898.

(No Model.) 9 Sheets—Sheet 5.



1443-1444

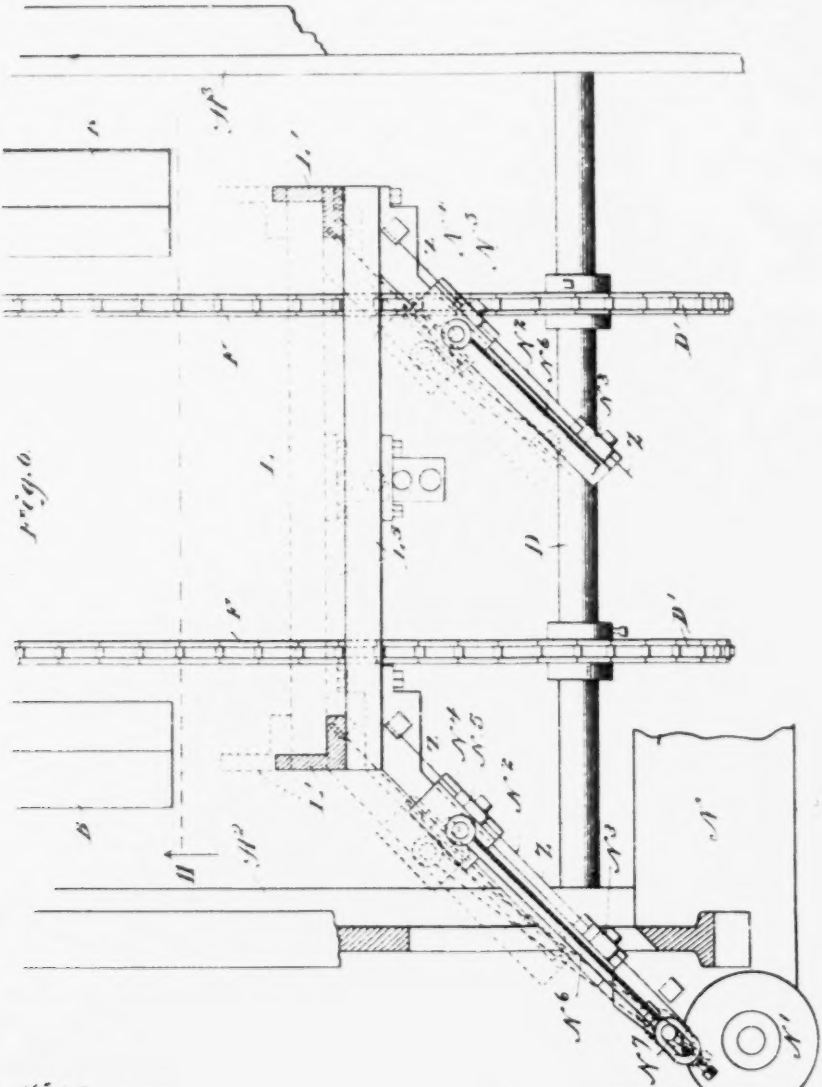
No. 614,348. Patented Nov. 15, 1898.

F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS.

Application filed June 20, 1898.

(No Model.) 9 Sheets—Sheet 6.



Witnesses.
D. F. Mann,
A. D. Spencer.

Inventor,
Frederick P. Rosback
By Dewey, Fairfield & Dewey,
Atty's.

No. 614,348. Patented Nov. 15, 1898.

F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS.

Application filed June 20, 1898.

(No Model.) 9 Sheets—Sheet 7.

Fig. 8.

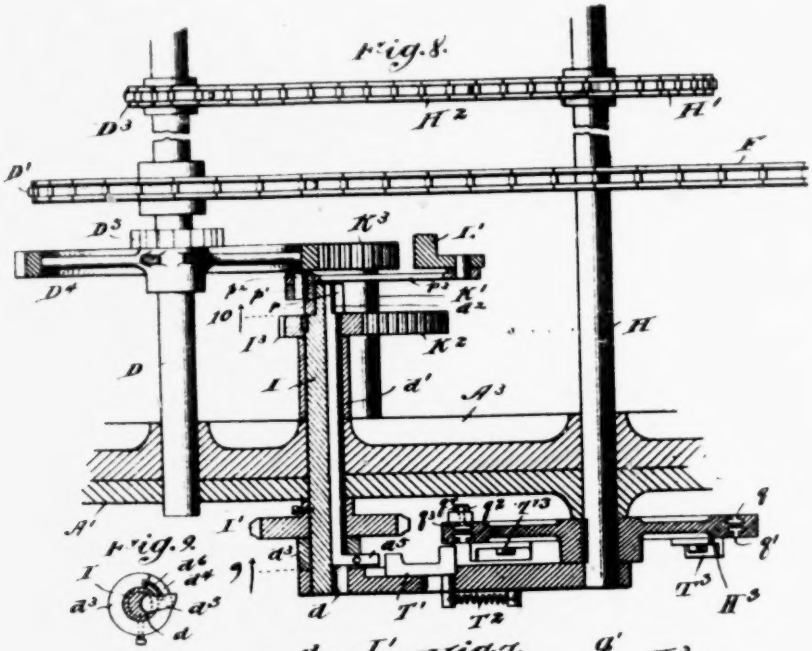


Fig. 9.

Fig. 7.

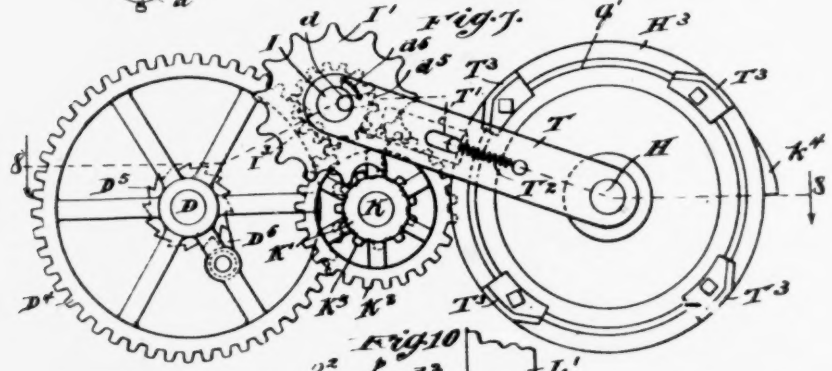
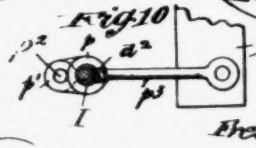


Fig. 10.



Witnesses,
F. E. Mann,
R. P. Spencer.

Inventor,
Frederick P. Rosback.
By Dyrenforth & Dyrenforth,
Atty.

1447-1448

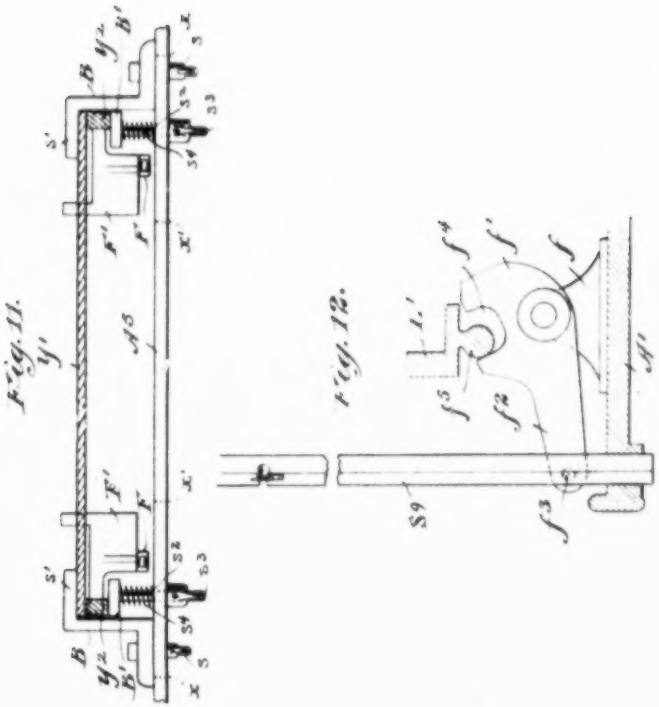
No. 614,348. Patented Nov. 15, 1898.

F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS.

Application filed June 20, 1898.

(No Model.) 9 Sheets—Sheet 6.



Witnesses.
W. D. Mann
R. J. Spencer

Inventor.
Frederick P. Rosback
By Dyrenforth & Dyrenforth,
Attys.

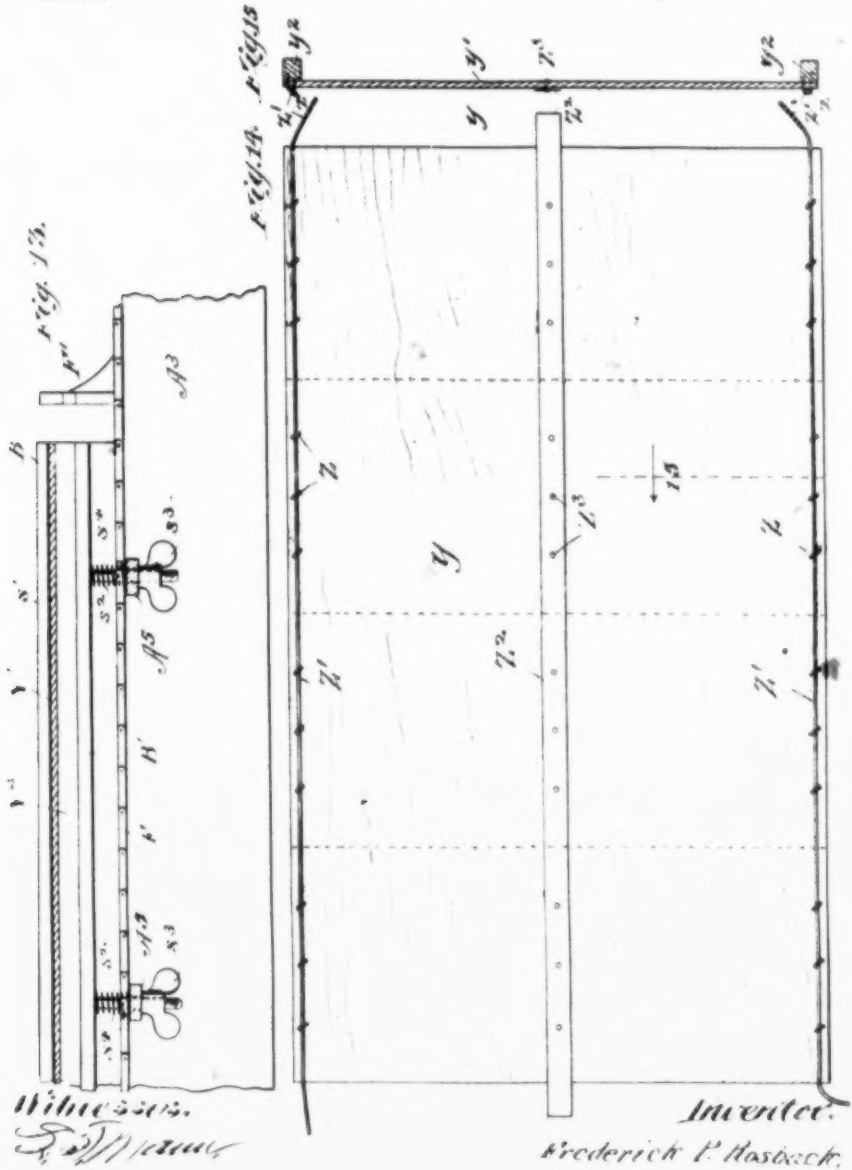
No. 614,348. Patented Nov. 15, 1898.

F. P. ROSBACK.

MACHINE FOR MAKING BOX BLANKS.

(Application filed June 20, 1898.

(No Model.) 9 Sheets--Sheet 9.



Witnesses.

Inventor.

Frederick P. Rosback.

By Dyrenforth & Dyrenforth
Attys.

the guide through which the blanks are advanced into the machine, of a wire-end engager on the guide operating to engage and turn back the projecting ends of the wires, substantially as and for the purpose set forth.

Frederick P. Rosback.

In presence of R. T. Spencer, J. H. Lee.

(Here follow side folios 1433-1450)

[fol. 1451] United States Patent Office

Frederick P. Rosback, of Chicago, Illinois, Assignor to William P. Healy, of Same Place

Machine for Making Box-Blanks

Specification Forming Part of Letters Patent No. 614,348, Dated November 15, 1898

Application filed June 20, 1898. Serial No. 683,975. (No model.)

To all whom it may concern:

Be it known that I, Frederick P. Rosback, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Machines for Making Box-Blanks, of which the following is a specification.

This invention relates to improvements in machines for making blanks for boxes, the blanks consisting each of a sheet of lumber or the like provided on one side with reinforcing-cleats and at its opposite side with strengthening wires or bands, the sheet and cleats being secured together by means of staples, nails, or the like, which also pass over or through strengthening wires or bands to hold them in place. Each blank is of a length to make four sides of a box, the cleats and sheets being cut away or step-mitered at the proper points to permit folding of the blank. In Patent No. 608,796, granted August 9, 1898, I have shown, described, and claimed a machine for making box-blanks,

many of the details of the present machine being substantially the same as those in the machine forming the subject of the said patent. The difference between the present machine and the said former machine lies mainly in the fact that while in the former machine the blank material was fed intermittingly through the machine, alternating with the action of the staple-drivers or tacking devices, in the present machine the blank material moves steadily instead of intermittingly through the machine, the staple-drivers or tacking devices being mounted upon an oscillating or swinging support, which while the devices are performing the tacking operation moves with the blank material. The blank shown in the said pending application is formed of a sheet with cleats at opposite edges and three strengthening-wires, one at each of the cleats and one intermediate thereof, all the strengthening-wires being fastened in place by means of staples. The present machine may be provided with three staple forming and driving devices, the same as the other machine, or it may be provided with means for feeding one or more bands or flat strips of metal or other suitable material in place of the strengthening-wires and fastening them in place with nails instead of staples. Thus for purposes of illustration the present machine is shown provided with means for feeding strengthening-wires and making and driving staples at opposite edges of the blank and means for feeding a wide band along the central line of the blank and fastening it in place with nails clenched on the under side of the blank. For the reason that the present machine, as before stated, involves a number of details shown, described, and claimed in the said former patent only so much of the mechanism is herein shown as is thought necessary to illustrate an operative machine without setting forth details, which, owing to the said patent, cannot be claimed in the present case.

Referring to the drawings, Figure 1 is a view in elevation of the right-hand side of the machine; Fig. 2, a view in elevation of the left-hand side of the machine, certain features hidden by the frame being indicated by dotted lines; Fig. 3, a cross-section of the machine with the tacking devices removed, taken on line 3 of Fig. 1, corresponding with line 3 of Fig. 2, and viewed as indicated by the arrows; Fig. 4, a rear end elevation with a part broken

away and with the end brace-bar removed and the side bars at the rear end in section; Fig. 5, an enlarged broken section taken on line 5 of Fig. 3, corresponding with line 5 of Fig. 4, and viewed as indicated by the arrows; Fig. 6, an enlarged broken sectional plan view taken on line 6 of Fig. 4 and showing only part of the blank-feeding mechanism, tacking-device support, and staple-wire feeders; Fig. 7, an enlarged detail view of the driving mechanism for the feed-chains; Fig. 8, a broken plan section taken on the irregular line 8 8 in Fig. 7; Fig. 9, a section taken on line 9 of Fig. 8 and showing a detail of the construction of clutch mechanism; Fig. 10, a broken sectional view taken on line 10 of Fig. 8 in the direction of the arrow and showing details of construction of the tacking-device-support-oscillating mechanism; Fig. 11, a broken detail view in the nature of a section taken on line 11 of Fig. 6, viewed in the direction of the arrow and showing a box-blank in cross-section; Fig. 12, a broken sectional view of details connected with the nail-feeding mechanism, the section being en- [fol. 1452] larged and taken on line 12 of Fig. 4 in the direction of the arrow; Fig. 13, an enlarged broken section taken on line 13 of Fig. 3 and viewed in the direction of the arrow, illustrating the blank-feeding mechanism; Fig. 14, a top or outer plan view of a completed box-blank; Fig. 15, a cross-section of the blank, taken on line 15 of Fig. 14; Fig. 16, an enlarged vertical section of parts of an oscillating frame which carries the tacking devices and showing one of the tacking devices in side elevation, and Fig. 17 a broken view showing the lower forward end of a stapling device and the shaft which severs the strengthening-wire.

The main frame of the machine consists of a right-hand cheek A, mounted upon legs l l, a left-hand cheek A', mounted upon legs l' l', a frame consisting of a right-hand bar A^2, a left-hand bar A^3, joined at the front and rear ends by cross-bars, (not shown) the said side bars being set into the inner faces of the cheeks, as indicated in Figs. 3 and 4, to be supported thereby at their rear ends and provided at their forward ends with legs l^2. Intermediate of the said end bars is a cross-bar A^4, (see Fig. 4,) ex-

tending between the cheeks A A' above their forward legs to be out of the way of wheels and drive-chains.

B B are sheet and cleat guides mounted at opposite ends upon crosswise-extending bars A^3, (see Figs. 11 and 13,) which are suitably supported at opposite ends by the side bars A^2 A^2. The guides B B are adjustably fastened upon the bars A^3 by means of bolts and thumb-nuts s s, which pass through longitudinally-extending slots in the bar A^3, the said slots extending, say, from the points x to the points x' at the opposite end portions of the bar A^3, as indicated in Fig. 11. The guides B have overlapping edges s' s' to receive the edges of the sheet Y' of the blank Y, as shown in Fig. 11, the cleats Y^2 resting on guide-bars B' underneath the overlapping edges s'. The bars B' are provided with downward-extending bolts s^2, which extend through the slots in the bars A^3, being fastened in place by means of thumb-nuts s^3. Surrounding the bolts s^2 are springs s^4, which tend to hold up the bars B' and render them slightly yielding in the downward direction.

The object of having the bars B' yielding is to prevent binding of the cleats and sheet as they pass through the guides, particularly when, as frequently happens, they vary in size.

In practice the front ends of the bars B' (broken away in Fig. 13) are left slightly lower than the rear ends the more readily to permit a new blank to be introduced. If desired, the upper front edges of the bars may be rounded somewhat, though I have found the expedient first mentioned sufficient in practical operation.

C is the main operating-shaft of the machine, journaled at opposite ends in the upper ends of the cheeks A A' and provided beyond the cheek A' with a belt-pulley C", which in practice is belted to a line-shaft or other suitable power. The pulley C" rotates constantly, and between the said pulley and shaft C is clutch mechanism r, which may be of the same construction as the clutch mechanism in the same position of the machine shown in my aforesaid patent. The said clutch mechanism is actuated by a rod C^2, passing near its upper end through a guide-sleeve r' on the cheek A' (see Fig. 2) and fitting at its lower end in a guide-block r^2 on the floor. It will suffice to say in the present connection that movement of the rod C^2 in the downward

direction causes the clutch r to produce engagement between the pulley C′ and shaft C, whereby the latter rotates and rise of the rod C^2 operates the clutch r to release engagement between the said pulley and shaft, whereby the shaft ceases to rotate.

It may be added for ease of understanding that the clutch is spring-actuated to cause engagement between shaft and pulley and that the function of the rod C^2 when raised is simply to engage a suitable projection (not shown) on the clutch, and thereby overcome the force of the spring and disengage the clutch members. When the rod is lowered, the spring is left free to act and throw the clutch members into engagement again.

Journaled toward opposite ends in the main frame, near the front and rear ends of the latter, are cross-shafts D and E. On the shaft D, between the side bars A^2 A^3, is a pair of laterally-adjustable sprocket-wheels D′, and on the shaft E is a similar pair of laterally-adjustable sprocket-wheels E′. Extending over the sprocket-wheels D′ E′ are feed-chains F, each provided with two similarly-located projecting blank-engaging feed-lugs F′. (See Figs. 2, 11, and 13.)

As in the former machine, when the blank material is first placed in the machine it is advanced quickly forward to the tacking devices by means of preliminary feed mechanism and is then released from the preliminary feed mechanism and advanced at a slower and predetermined rate of speed beneath the tacking devices.

The preliminary feed mechanism of the present machine will be first described.

G is a shaft journaled in a bearing on the side cheek A and carrying a pulley G′, which in practice is belted to a line-shaft or other suitable power to rotate constantly. On the shaft G is a sprocket-wheel G^2. Fulcrumed upon the shaft G is a bell-crank lever G^3, having the arms G^4 and G^5. (See Fig. 1.) Journaled upon the free end portion of the arm G^5 is a friction-wheel G^6 and a sprocket-wheel G^7, the sprocket-wheel G^7 being geared to the sprocket-wheel G^2 by means of a drive-chain G^8. On the shaft D is a friction drum or pulley D^2. The friction-wheel G^6 may be swung into engagement with the friction-pulley D^2, but is held normally out of contact therewith by means [fol. 1453] of a spring G^9, (see Fig 1,) fastened at one end

to a lug f^3 on the cheek A and at its other end to the arm G^5 of the bell-crank lever.

Extending across the machine and journaled in the cheeks A A' is a rock-shaft G^{10}, upon which, beyond the cheek A', is fastened a lever G^{11}. Beyond the cheek A the shaft G^{10} carries a dog G^{12} in position to engage the arm G^4 of the bell-crank lever. In Fig. 3 the shaft G^{10} is shown to be bent upward between the cheeks, and this is merely done for the purpose of raising it between its ends above the path of the box-blanks.

When the blank material is first placed in the guides B, the operator presses down the lever G^{11} to rock the shaft G^{10} and turn the dog G^{12} against the arm G^4 of the bell-crank lever, whereby the latter is swung against the resistance of the spring G^6 to press the friction-wheel G^5 against the friction-pulley D^2. As before stated, the pulley G' revolves constantly, and through the drive-chain connection with the friction-wheel G^5 rotates the latter constantly, so that when the lever G^{11} is pressed down to bring about engagement between the friction-wheel G^5 and pully D^2 the shaft D, its sprocket-wheels D', and the drive-chains F are moved at comparatively great speed to cause the lugs F'' to engage the rear ends of the blanks and push them forward to the tacking devices. On the lever G^{11}, just beyond the shaft G^{10}, is a downward-extending swinging finger G^{13}, and on the side of the cheek A' is a lug or shelf f^4. When the lever G^{11} is depressed, as stated, the finger G^{13} is raised and drawn by a spring G^{14} to rest upon the shelf f^4, and thus hold the friction-wheel G^5 in engagement with the friction-pulley D^2 against the resistance of the spring G^6.

When the blank material has been advanced to the tacking devices, the preliminary feed mechanism is stopped, as hereinafter described.

H is a shaft extending across the machine and journaled in the cheeks in the positions shown in Figs. 1 and 2. Between the cheeks the shaft H carries a sprocket-wheel H', (see Fig. 8,) and on the shaft D is a sprocket-wheel D^3, the sprocket-wheels H' D^3 being geared together by means of a drive-chain H^2. The sprocket-wheel H' is three times the size of D^3, the sprocket-wheel D^3, whereby in the rotation of the shaft D the shaft H is driven at one-third

the speed of the former. The parts are so constructed with relation to each other that the shaft H will be given one complete revolution in the time that the drive-chains F move the distance of one-half of their lengths. On the shaft H, beyond the cheek A', is a disk or wheel H^3. (See, for example, Figs. 2 and 8.) On the inner and outer sides of the disk H^3 are annular T-grooves $q\,q'$, respectively. Adjustably fastened in the T-groove q is a projection or roller q^2. The roller q^2 is upon a bolt q^3, having a head which fits the T-groove. The bolt with the roller may be slid to any position around the T-groove q and fastened in adjusted position by means of a nut q^4. The finger G^{12} on the lever G^{11}, before described, is in the path of the roller q^2, and the latter is so positioned upon the disk H^3 that it will engage the finger G^{12} and slide it off the shelf f^4 when the forward edge of the blank material arrives at the tacking devices. Thus, as before described, the friction-wheel G^6 will be disengaged by the spring G^{10} from the friction-pulley D^2 and stop the preliminary feed.

I (see particularly Figs. 2, 5, and 8 to 10, inclusive) is a comparatively short shaft journaled between its ends in a bearing in the cheek A' and side bar A^3. On the shaft I, at the outer side of the cheek, is a sprocket-wheel I' geared, by means of a drive-chain I^2, to a sprocket-wheel C^4 on the drive-shaft C. Thus in the rotation of the shaft C the shaft I will be rotated. Near the inner end of the shaft I and keyed thereto is a pinion I^3.

K is a pin or stationary shaft fastened to the side bar A^3 and projecting inward just below the shaft I. On the shaft or pin K is a sleeve K', carrying a gear-wheel K^2, which meshes with the pinion I^3 and a pinion K^3, which meshes with a gear-wheel D^4 on the shaft D. Thus in the rotation of the shaft I the pinion I^3 rotates and turns the gear-wheel K^2 and pinion K^3 to turn the gear-wheel D^4 and shaft D. On the side of the gear-wheel D^4 is a ratchet-wheel D^5. The ratchet-wheel is keyed to the shaft D, while the gear-wheel D^4 is loose upon the shaft. Mounted upon one of the spokes of the gear-wheel D^4 is a pawl D^6, which in the rotation of the gear-wheel engages the ratchet and turns the shaft. When, however, the shaft D is turned from the friction-pulley D^2, as before described, the ratchet moves beneath the pawl E^6, so that the motion of the shaft

D is not conveyed to the shaft I and through the latter to the shaft C.

Hung from the shaft C and loosely fastened thereto at its lower end is an oscillating or swinging frame or movable support L, consisting of parallel downward-extending bars L' L', formed with the sleeves L^2 L^2, which surround the shaft, and a cross-bar or brace L^3. (Shown, for example, by dotted lines in Fig. 5.) The inner end of the shaft I is reduced, as shown in Figs. 8 and 10, and surrounded by a loose sleeve p, carrying a crank-arm p'. The sleeve p is fastened normally to the shaft I, to revolve therewith, by means of clutch mechanism hereinafter described. On the crank is a crank-pin p^2. A link p^3 is pivotally connected at one end to the crank-pin p^2 and at its opposite end is pivotally connected to the lower end portion of one of the side bars L' of the swinging frame L. Thus when the sleeve p and crank-arm are clutched to the shaft I the rotation of the shaft I causes the swinging frame L to be swung or oscillated back and forth on the pivot formed by the shaft C.

[fol. 1454] Mounted upon a cross-bar L^3, forming a part of the swinging frame L, are two staple forming and driving devices M M of the construction shown and claimed by me in my aforesaid pending application. As in my former construction, I provide a vertically-sliding cross-head M' for operating the driving-plungers of the stapling devices. This cross-head M' is actuated from eccentrics M^2 on the shaft C through the medium of connecting-rods M^3. I also employ a cross-head M^4 for operating the staple-formers, the same as in my aforesaid patent, the cross-heads M^4 being operated by eccentrics M' M' on the shaft C through the medium of the connecting-rods M^5. It is to be understood that the staple forming and driving devices, with their operating cross-heads M' M^4, are on and oscillate with the swinging frame L. It will suffice to say in the present connection that the movement of the cross-heads M' M^4 is the same as in the machine shown in my aforesaid patent, whereby staples are formed and driven out of the lower ends of the devices M in each revolution of the shaft C when staple-wire is fed thereto.

The manner of feeding stapling wire to the devices for [illegible]

the mechanism for the purpose shown in my aforesaid patent, and therefore will be described in detail. This mechanism is shown most plainly in Fig. 6. Extending across the rear end portion of the machine is a shelf N, broken away in Fig. 6 to avoid hiding the sprocket-wheels D'. In Fig. 6 only one staple-wire-feeding device is shown complete, the other being partly broken away, the construction thereof being similar to the construction of the one shown. On the shelf N for each stapling device is a wire-carrying spool N'. Fastened against the bar L^4 are arms N^2, just at the lower end portions of the staplers M, as shown in Fig. 4. These arms move with the frame L between the positions shown by full and dotted lines. On the outer end of each arm N^2 is a wire-engaging feed-pawl N^3. Sliding upon the arm N^2 is a sleeve N^4, carrying a wire-engaging pawl N^5. The sleeve N^4 is pivotally connected to the end of a rod N^6, which at its opposite end is pivotally connected to a pin N^7 on the shelf N. The wires Z, from which the staples are formed, extend from the spools N' beneath the pawls N^3 N^5 to the stapling devices M. In the movement of the frame L from the position shown in full lines in Fig. 6 to the position shown by dotted lines in that figure the pawls N^3 grip the wires Z and draw them from the spools. In the movement of the frame L from the position shown in dotted lines to the position shown in full lines the wires are held by the pawls N^5 and the pawls N^3 slide over the wires. Thus in this movement the stapling devices slide over the ends of the wires, which are thus brought into position to be cut and formed into staples.

The strengthening-wires Z' pass between guide-rollers P P, mounted on shafts P' P^2. On the shafts P' P^2 are pinions P^3 P^4, respectively, which intermesh. Loosely mounted on the rock-shaft G^{10} is a pinion P^5, which meshes with the pinion P^4. Also loosely mounted on the rock-shaft G^{10} is a star-wheel P^6. On the hub of the pinion P^5 is a ratchet P^7, and on the star-wheel is a pawl P^8. The star-wheel extends into the path of a crank-arm H^4, keyed to the shaft H. (See Figs. 3 and 5.)

When the first staples have been driven over the strengthening-wires to fasten them to the box-blank, the strengthening-wires will be drawn along by movement of the blanks,

When a box is formed from a blank, the ends are fastened together by twisting or otherwise fastening together the ends of the strengthening-wires, which are caused to project beyond the ends of the blank for that purpose, as indicated in Fig. 14. Therefore it is necessary to feed the strengthening-wires forward a short distance before the first staples are driven to fasten them to the blank. This forward-feeding of the strengthening-wires is brought about in the initial movement of the shaft H by the arm H^1 engaging with the star-wheel P^7 and turning it part of a revolution. In the turning of the star-wheel the pawl carried thereby engages and turns the ratchet P^7 and pinion P to rotate the pinions P^1 P^2, and consequently the shafts P' P^3 and feed-wheels P. In the travel of the blank through the machine thereafter the wires are drawn between the feed-wheels P, the rotation of the shafts and gears P', P^1, and P^7 causing no rotation of the star-wheel on account of the fact that the ratchet P^7 will slide on the pawl P^8.

The upper surface of the bar L' of the frame L may form the anvil against which the staples are clenched.

On the lower end portion of each staple device M is a tubular backward-extending part M', having a strengthening-wire-guiding opening a' with a flaring mouth a and affording a bearing for a cross-shaft R. (See Figs. 5 and 16.) The shaft R is journaled at opposite ends in the side bars L' of the swinging frame and is provided beyond one of said bars (see Fig. 5) with a crank R'. In the shaft are wire-cutting slots a^2, coincident with the openings a', and through which the strengthening-wires Z' pass. The slots a^2 are of a length sufficient to permit the lateral adjustment of the stapling devices according to the width of blank to be produced, and in practice the slots may be of substantially the same length as the slots in the bars N^2, (see Fig. 11,) before described. In front of the shaft R the openings through the wire-guide projections M' are but little larger in diameter than the strengthening-wires, and the openings of the slots a^2 at the forward edge of the shaft are reduced to the same size, so that wire-cutting edges or shears a^3 are [fol. 1455] produced. Normally the shaft R is in the position shown in Fig. 5, whereby the passage through the wire-guides M' is free, so that the wires can pass through un-

obstructed. The crank R' is pivotally connected at its free end by means of a pin R^2 to a vertically-movable bar or lever R, having at its upper end a backward-extending lip or projection R^3. The pin R^2 forms a pivot upon which the bar of lever R may swing, and the said bar or lever has a downward-extending arm carrying a roller R^4. A spring R^5, fastened at one end to a lug upon the side bar L' and at its other end to the upper end portion of the bar or lever R, tends to hold the said bar or lever in the retracted position shown in Fig. 5. In the cross-head M' is a groove *m*. Pivoted upon a pin *l* at the side of the same bar L' of the swinging frame is a lever *l'*, having an upward-extending arm, which bears against the roller R^4, and a downward-extending arm carrying a roller l^2 in the path of an arm l^3, fastened to the shaft H. In practice the arm l^3 which turns with the shaft H, engages the roller l^2 of the lever *l'* just before the machine stops, and in so doing swings the lever R so that the lip R^3 engages the groove or recess *m* of the cross-head M' while the latter is rising. Thus in the final upstroke of the cross-head the lever R is drawn upward to turn the crank R' and shaft R to cut off the wires Z' just before the machine stops. The machine stops just as the arm l^3 passes beyond and disengages the roller l^2, whereby the lever R is withdrawn by the spring R^5 from the slot *n*, and, descending by gravity, turns the cutting-shaft R to its normal position.

As before stated, as soon as a blank is completed the machine stops. This stoppage is performed by the following mechanism: Pivoted upon the chock A' at *k* (see Fig. 2) is a bell crank lever *k'*, pivotally connected at one of its arms to a pin k^2 on the rod C^3 and provided at the end of its other arm with a projection k^3. On the circumferential edge of the disk H is a projecting cam k^4, into the path of which the projection k^3 of the bell-crank lever extends. A spring k^5, fastened at one end to the bell-crank lever and at its other end to a lug on the chock A', tends normally to hold the bell-crank lever against the circumferential surface of the disk H and to draw the rod C^3 downward to the clutch-engaging position. The cam k^4 is so positioned upon the disk H that it engages the bell-crank lever *k'* and swings it to its clutch-releasing position just after a blank is completed and the strengthening wires have been cut. On the

block i^2 is a pawl i, connected by a rod i' with a bell-crank lever i^3, pivoted upon a block i^4 on the floor. One arm of the bell-crank lever i^3 forms a treadle or foot-lever i^5. A spring i^6 tends to press the pawl i against the rod C^4, whereby when it is raised to clutch-releasing position it engages a notch i^7 in said rod. After the blank material has been advanced by the preliminary feed, as before described, to the tacking devices the operator may start the operation of the machine by pressing down the foot-lever i^5 to release the rod C^4 and cause it to produce engagement of the clutch members between the shaft C' and pulley C^6, as before described.

It may be stated that when the machine is at rest after a blank has been completed the parts described are in the position shown in Fig. 2, whereby the cam k^4 will prevent swinging of the bell-crank lever k' to start the machine until after the disk H has been moved from that position by the operation of the preliminary feed.

In the drawings I have shown the machine provided with means for feeding and fastening a band or strip of metal Z^2 along the center of the blank instead of a strengthening-wire. In my former patent I showed a blank provided with a third strengthening-wire along the center, and the present machine is adapted to manufacture such a blank by providing a third stapling device M in place of the nailing mechanism shown. The nailing mechanism I prefer is substantially of the form shown and described in Letters Patent No. 608,917, granted August 9, 1898, "Box nailing and printing machine"—that is to say, I have merely taken the idea therefrom of a nail-supplier, feeder, positioner, and driver. For this reason the nailing mechanism, which is not specifically claimed in the present application, is not shown in detail. It will suffice to say that journaled in the cheeks A A' is a rock-shaft S, provided beyond the cheek A' with a crank S', connected by means of a crank-rod S^2 with a crank S^3 on the end of the shaft D. Thus in the rotation of the shaft D the shaft S is rocked. Fastened upon the shaft S is a nail-reservoir S^4, from which extends a nail-guide S^5 to a flexible nail-feeding tube S^6, which extends to a nail-positioner S^7 upon the bar L^4 of the swinging frame. Mounted upon the bar L^5 of the swinging frame, just below the nail-positioner S^7, is a nail-clenching block

8^{x}. The nail-driver or plunger, which works through the nail-positioner 8^{y}, is fastened to the cross-head M'. 8^{z} is the nail-feeding valve, located between the nail-guide 8^{y} and feed-tube 8^{x}, the construction being the same as in my aforesaid pending application. The valve 8^{z} reciprocates longitudinally in guides upon a brace-bar A^{x}, extending between the cheeks A A'. On the inner side of the cheek A' is a bracket f, (see Fig. 12,) on which is fulcrumed a bell-crank lever f', having an arm f^{2}, pivotally connected by means of a pin f^{3} with the valve 8^{z}, and having an arm provided with a socket f^{4}, which engages a knob or lug f^{5} on the adjacent surface of the side bar L' of the swinging frame L. As the frame L swings, the engagement of the knob f^{5} with the lever f' oscillates the latter, causing it to reciprocate the valve 8^{z} and thus feed one nail Z at the proper time to the feed-tube 8^{x}, which guides the nail to the [fol. 1456] nail-positioning device. Thus in each descent of the cross-head M' the nail-driver operates to drive a nail and the staple-drivers operate to drive staples. The band Z is fed between rollers l^{x} on the shafts l^{w} l^{y}, and the feeding is performed in the same way as the strengthening-wires Z'. The band passes through a slot a^{2} in the rock-shaft R and is severed in the same way as the strengthening wires are severed. The band Z is preferably of thin metal or wood, and the nails are driven therethrough and through the sheet Y' and clenched on the under side.

If desired, nailing devices like the one shown may be provided instead of stapling devices, and my invention contemplates the use of staple-driving devices alone, nailers alone, or one or more of each, all being embraced in the term "tacking devices" employed in the claims.

When the blank Y has passed from the present machine, it is provided on its inner side with preferably step-miter cuts to permit the blank to be bent and produce the corners or edges of the box.

In order that no staples or nails may be driven at the points where the step-miter cuts are to be produced, I provide in the present machine skipper mechanism, which will be next described.

In the machine shown in my aforesaid Letters Patent, No. 608,796, and in the machines previously constructed for

the manufacture of box-blanks the skipping has been produced by accelerating the feed of the blank through the machine at proper stated intervals. In the present machine the skipping is produced by withholding the driving of nails or staples at proper stated intervals, this withholding being produced by preventing the feed of staple-wire or nails to the tacking devices.

The oscillation of the frame L, which carries the tacking devices, is produced, as before described, by the shaft I turning the crank p' on the sleeve p. In the shaft I, at one side, is a longitudinally-extending groove d, into which is fitted a rock-shaft d', having a reduced end portion d^2 in the reduced end of the shaft I. On the shaft I and turning therewith is a collar d^3, provided in its side with an elongated recess d^4, through which projects a crank d^5, which is an integral part of the rock-shaft d'. The crank d^5 is held normally in position to project beyond the circumference of the collar by a spring d^6. When the crank projects beyond the circumferential face of the collar d^3, the rock-shaft d' is turned axially to a position wherein its reduced end d^2 projects into a recess in the sleeve p, as indicated in Fig. 10. Thus the sleeve p is clutched to the shaft I, whereby in the rotation of the shaft the swinging frame L is oscillated.

T is a bar beyond the side cheek A' of the machine, at one end surrounding the shaft H and at the opposite end surrounding the shaft I. On this bar is a sliding block T', held normally in the retracted position shown in Figs. 7 and 8 by a spring T², which spring is fastened at one end to a stud on the bar and on its opposite end to a stud on the sliding block. Adjustably fastened in the annular T-groove q' of the disk H are four cam projections T³, which in the rotation of the disk H engage the end of the block T' and slide it longitudinally against the surface of the collar d^3 into the path of the crank arm d^5 on the clutch or rock shaft d'. Thus each time a cam T³ engages and moves the sliding block T' it moves the block against the collar d^3 and into the path of the crank arm d^5, thereby causing the clutch or rock shaft d' to be turned against the resistance of the spring d^6 and release the sleeve p, whereby for one revolution of the shaft I the swinging frame L remains station-

ary. Each time the said frame remains stationary it fails to produce the feed of stapling-wire for one staple and fails to produce the feed of one nail to the nail positioning and driving devices. Therefore in the downward plunge of the nail and staple drivers no nails or staples will be in position for discharge and the proper spaces on the blank will be skipped in the sense that no nails or staples will there be driven. For blanks of different lengths to produce boxes of different sizes the cams T may be adjusted as desired.

It will be understood from the foregoing description that the present machine is for the manufacture of box-blanks comprising, more especially, a sheet, which may be one or a number of adjacent abutting pieces and cleats, all of which are advanced through the sheet and cleat-guides B and reinforced with strips, which may be strengthening wires or bands of metal or other suitable material. The strips, sheet, and cleats are secured together by means of fasteners, which may be staples, nails, or the like. The tacking devices, which drive the fasteners, are upon a frame or support which oscillates, in the sense that it moves in the forward direction before each tacking operation, and during each tacking or fastener driving operation it moves in the backward direction at approximately the same speed as the blank into which the fasteners are being driven. If strengthening-strips in the form of wires are to be used for strengthening the box blank, two, three, or more staple devices are placed upon the oscillating frame or support and the proper number of wire-feed rollers, wire-supplying reels, and accompanying mechanism described placed in position. If strengthening strips in the form of bands are to be provided upon the blank, the desired number of tacking devices in the form of nailers are placed in the machine with the accompanying band-feeding devices. The sheet and cleat guides B may be adjusted toward and away from each other to guide blank material of any desired width, and the tacking devices may be placed upon their supports in [fol. 1457] the proper position to work upon the blank. The feed-chains F and their sprocket-wheels may be adjusted laterally to be in proper position for engaging the sheet and cleats. The various adjustments may be effected very quickly, so that little time will be required to change the

machine over for the manufacture of any style or size of blank. In the event that it is desired to form blanks with the sheets and strengthening strips without the reinforcing-cleats it will only be necessary to raise the guide-bars B' and provide a clencher like the clencher s' beneath each of the tacking devices employed. In the event that it should be desired at any time to manufacture blanks without the strengthening-strips this may be done by leaving off the means for supplying the strengthening-strips.

While I prefer to construct my improvements throughout as shown and described, it is obvious that they may be modified in the matter of details of construction without departing from the spirit of my invention as defined by the claims.

What I claim as new, and desire to secure by Letters Patent, is

1. In a machine for fastening a strengthening strip to a sheet, the combination of feed mechanism for advancing the sheet and strengthening strip longitudinally through the machine, a movable support, a tacking device on the support adjacent to the path of the strengthening strip, means for actuating the tacking device to drive fasteners, and means for moving the tacking device with the strip and sheet while the fasteners are being driven, substantially as and for the purpose set forth.

2. In a machine for fastening a strengthening strip to a sheet, the combination of feed mechanism for advancing the sheet and strip longitudinally through the machine, a movable support, a tacking device on the support adjacent to the path of the strip, means for actuating the tacking device to drive fasteners, means for moving the tacking device with the strip and sheet while the fasteners are being driven, and fastener-supplying mechanism for the tacking device operated by said movement of the tacking device, substantially as and for the purpose set forth.

3. In a machine for fastening a strengthening strip to a sheet, the combination of feed mechanism for advancing the sheet and strip longitudinally through the machine, a movable support, a tacking device on the support adjacent to the path of the strip, means for actuating the tacking de-

vice to drive fasteners, means for moving the tacking device with the strip and sheet while the fasteners are being driven, fastener-supplying mechanism for the tacking device operated by said movement of the tacking device, and skipper mechanism operating, relative to the feed mechanism, to withhold movement of the tacking device at stated intervals, whereby no fasteners will be driven thereby, substantially as and for the purpose set forth.

4. In a machine for fastening a sheet to a cleat, the combination of feed mechanism for advancing the sheet and cleat longitudinally through the machine, a movable support, a tacking device on the support adjacent to the path of the sheet, means for actuating the tacking device to drive fasteners, and means for moving the tacking device with the sheet and cleat while the fasteners are being driven, substantially as and for the purpose set forth.

5. In a machine for fastening a sheet to a cleat, the combination of feed mechanism for advancing the sheet and cleat longitudinally through the machine, a movable support, a tacking device on the support adjacent to the path of the sheet, means for actuating the tacking device to drive fasteners, means for moving the tacking device with the sheet and cleat while the fasteners are being driven, and fastener-supplying mechanism for the tacking device operated by the said movement of the tacking device, substantially as and for the purpose set forth.

6. In a machine for fastening sheet to a cleat, the combination of feed mechanism for advancing the sheet and cleat longitudinally through the machine, a movable support, a tacking device on the support adjacent to the path of the sheet, means for actuating the tacking device to drive fasteners, means for moving the tacking device with the sheet and cleat while the fasteners are being driven, fastener-supplying mechanism for the tacking device operated by said movement of the tacking device, and skipper mechanism operating, relative to the feed mechanism, to withhold movement of the tacking device at stated intervals, whereby no fasteners will be driven thereby, substantially as and for the purpose set forth.

7. In a machine for forming box-blanks, by fastening sheets and strengthening strips to reinforcing cleats, the

lating support, fastener driving tacking devices on the support adjacent to the path of the blank material, and means for moving the support on its pivot in the backward direction at approximately the speed of travel of the blank material while fasteners are being driven, substantially as and for the purpose set forth.

11. In a machine for forming box-blanks, the combination with the feed mechanism for the blank material, of a pivotally-mounted support, fastener driving tacking devices on the support adjacent to the path of the blank material, means for moving the support on its pivot in the backward direction at approximately the speed of travel of the blank material while fasteners are being driven, and skipper mechanism operating at predetermined intervals in the passage of the blank material to withhold movement of the said support, thereby to prevent feeding of fasteners to the driving mechanism, substantially as and for the purpose set forth.

12. In a machine for forming box-blanks, the combination with the drive-shaft, of feed-belts for engaging and moving the blank material through the machine geared to the drive-shaft, preliminary feed-operating mechanism comprising gear mechanism which may be thrown at will into operative engagement with the feed-belts to advance the blank material into the machine, and adjustable preliminary feed-disengaging mechanism actuated by the advance of the feed-belts to a predetermined position in the machine, substantially as and for the purpose set forth.

13. In a machine for forming box-blanks, the combination with the drive-shaft and feed for the blank material, of a movable support adjacent to the path of the blank material actuated from the drive-shaft to move back and forth and in its movement in the backward direction to travel at approximately the speed of the blank material, a cross-head on the support geared to the said drive-shaft, and a fastener driving tacking device on the support connected to the said cross-head, substantially as and for the purpose set forth.

14. In a machine for forming box-blanks, the combination with the drive-shaft, of feed-chains for the blank mate-

[fols. 1459 & 1460] into the blank material, a nail-supplier, the nails being fed to the device by the movement of the support in the forward direction, and a nail-clencher on the support, substantially as and for the purpose set forth.

18. In a machine for forming box-blanks, the combination with the main frame, of the movable support L, staple forming and driving device M on the support, arm N^2 movable with the support, staple-wire supplier N', pivotal connection N^3, sliding block N^4, pawl N^5 on the sliding block and pawl N^6 on the arm N^2, all constructed and arranged to operate substantially as and for the purpose set forth.

19. In a machine for forming blanks by tacking a sheet and strengthening-strips to reinforcing-cleats, the combination of guides for the cleats, feed mechanism for advancing the cleats longitudinally in their guides and with a sheet and strengthening-strips through the machine, a fastener-driving device adjacent to the path of each strengthening-strip, operating to fasten the strip and sheet, by successive operations, to the cleats, means for guiding the strengthening-strips with the sheet and cleats across the fastener-driving devices, and relative skipping means actuated by the said feed mechanism, and operating, at predetermined intervals, in the passage of the sheet and cleats through the machine, to prevent a single fastener-driving operation of the fastener-driving devices, and thereby produce an increase of the distance between points of tacking, substantially as described.

20. In a machine for forming box-blanks, the combination with the drive-shaft and feed for the blank material, of the rotating shafts I H, swinging frame L eccentrically geared to the shaft I, clutch on the shaft I for gripping and releasing the eccentric-gear, disk H^1, cams T^5 adjustably mounted on the disk, and a sliding clutch engaging and releasing block at the shaft I in the path of said cams, all constructed to operate substantially as and for the purpose set forth.

Frederick P. Rosback.

In presence of M. J. Frost, R. T. Spencer.

(Here follow side folios 1461-1488.)

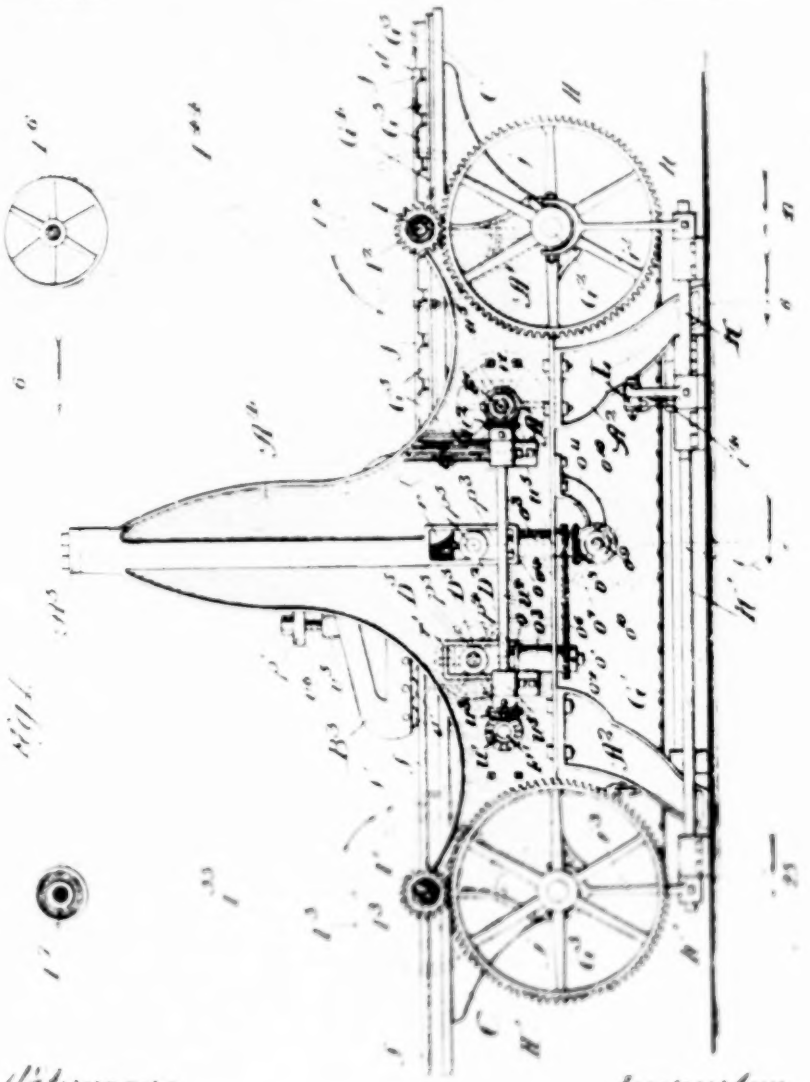
No. 623,258 Patented Apr. 18, 1899.

F. P. ROSBACK.

MACHINE FOR STEP MITERING BOX BLANKS.

Application filed Dec. 23, 1898.

No Model. 14 Sheets—Sheet 1.



Witnesses:

Inventor:
Frederick P. Rosback,
By Dodd & Stanford
Attys.

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F. P. ROSBACK.

MACHINE FOR STEP MITERING BOX BLANKS.

(Application filed Dec. 29, 1898.

(No Model.) 14 Sheets—Sheet 2

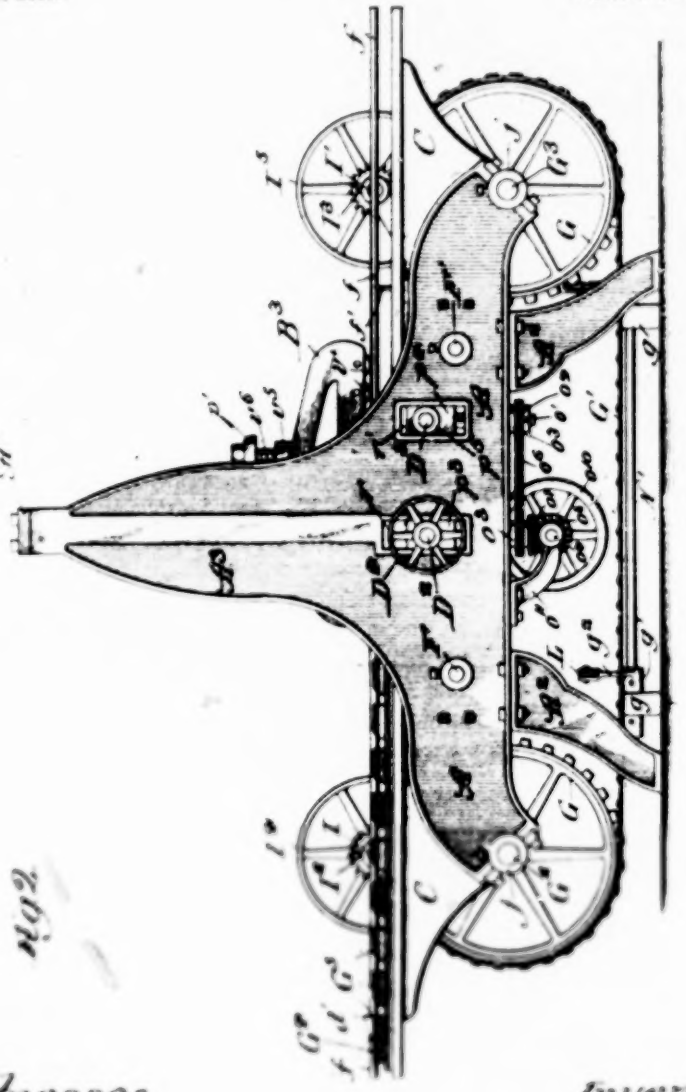

Fig 2.

Witnesses
Chas. F. Sanford
Edith S. Gillis.

Inventor:
Frederick P. Rosback.
By Dyrenforth Dyrenforth & Dyrenforth
Attys.

1465-1466

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F. P. ROSBACK.

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(Application filed Dec. 22, 1898.)

(No Model.) 14 Sheets—Sheet 3.

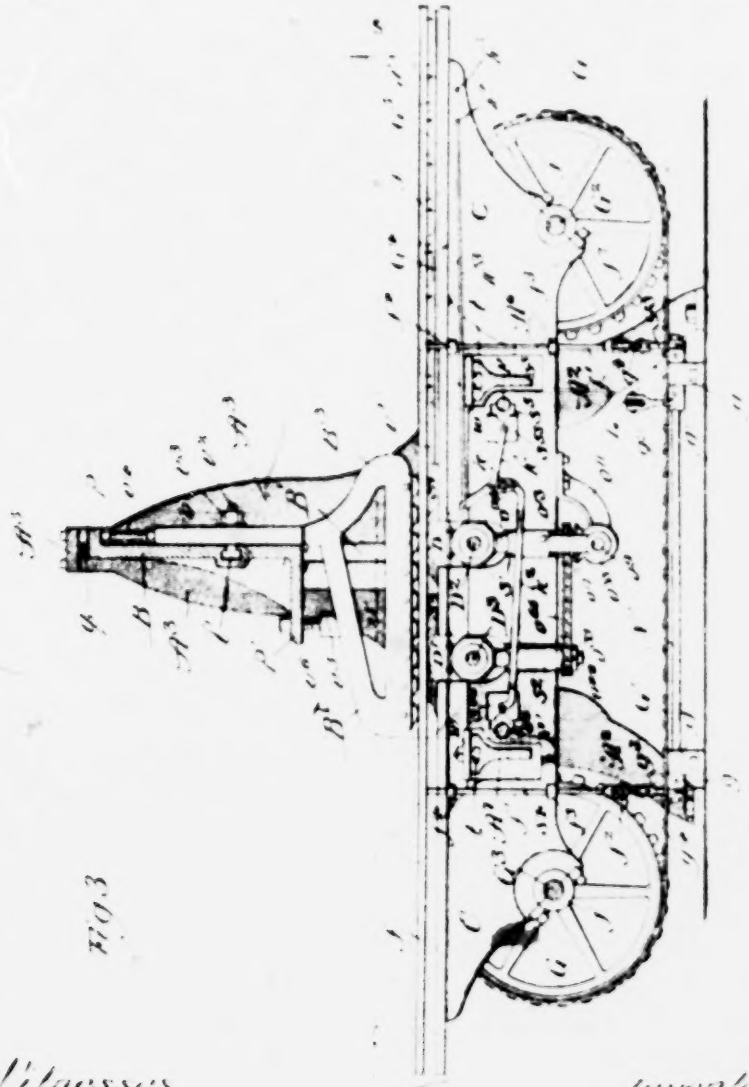


FIG. 3.

Witnesses:

Inventor:
Frederick P. Rosback

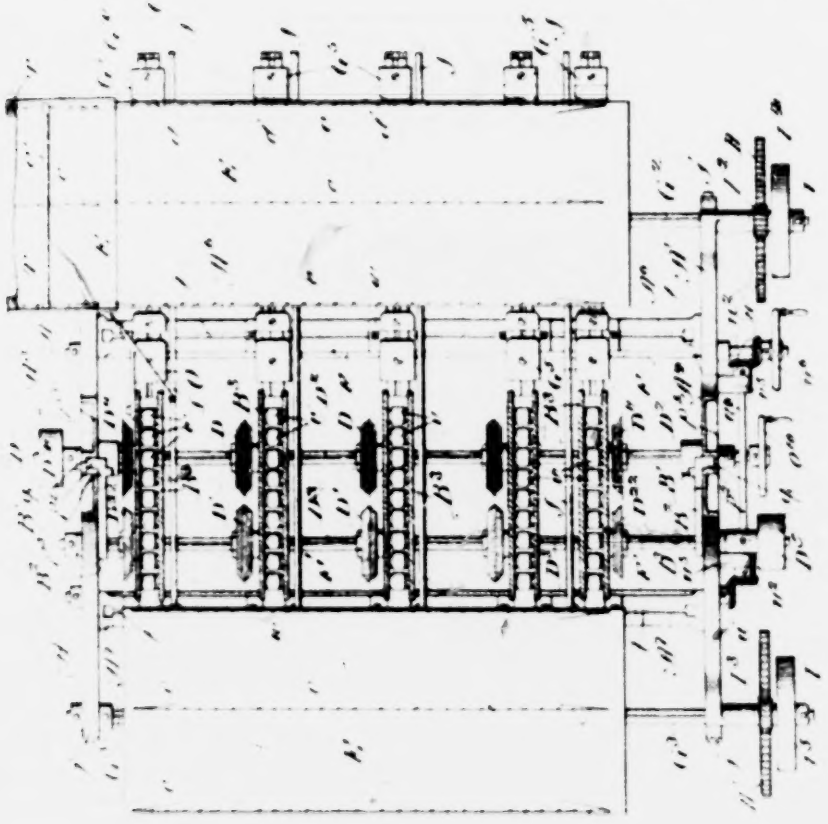
No. 623,258 Patented Apr. 18, 1899.

F. P. ROSBACK.

MACHINE FOR STEP MITERING BOX BLANKS

Application filed Dec. 29, 1898.

No Model. 14 Sheets—Sheet 4



Witnesses:
Chas. E. Taylor
Emil F. Pfaff

Inventor:
Frederick P. Rosback
by Dyrenforth & Dyrenforth
Attys.

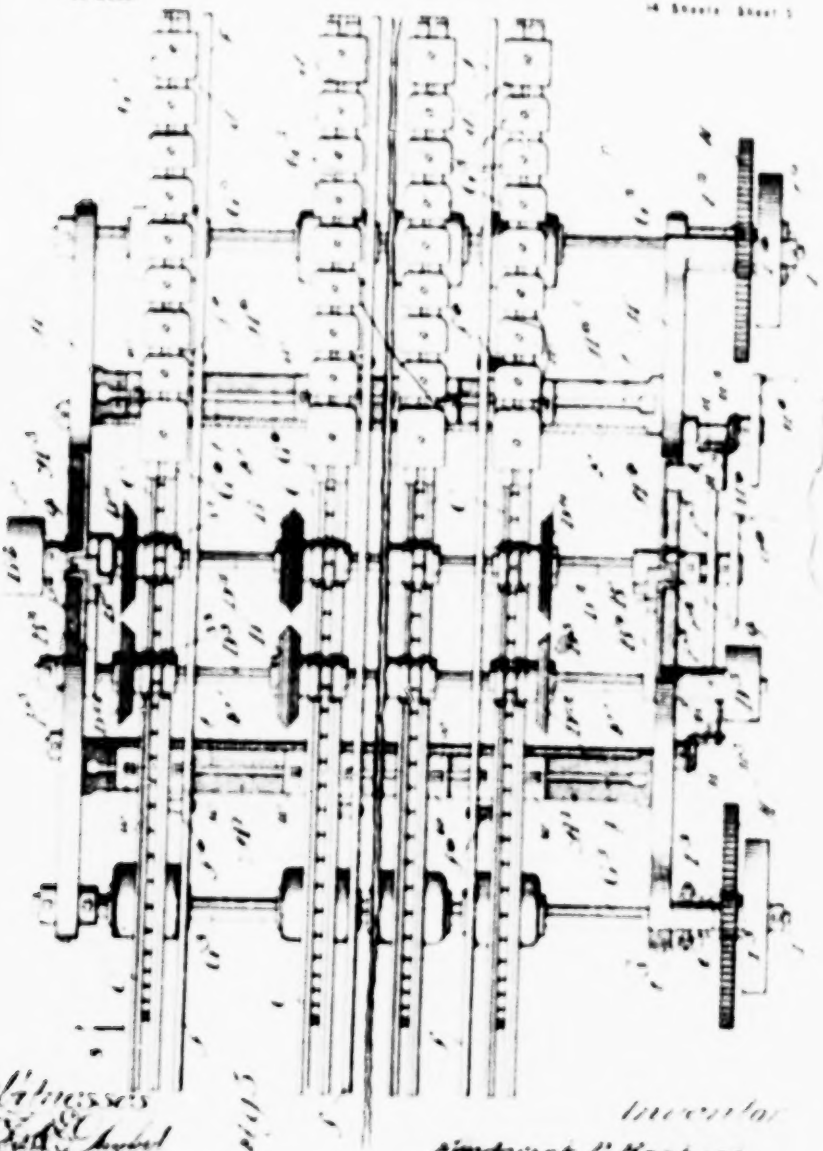
1469-1470

No. 623,258 Patented Apr. 18, 1899

F. P. ROSBACK

MACHINE FOR STEP MITERING BOX BLANKS

(No Model.) (4 Sheets-Sheet 1)



Witnesses
Chas. E. Lyford
Fabius H. Mayo

Inventor
Frederick P. Rosback
by Dyrenforth & Dyrenforth
his Attorneys

1471-1472

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F. P. ROSBACK.

MACHINE FOR STEP MITERING BOX BLANKS

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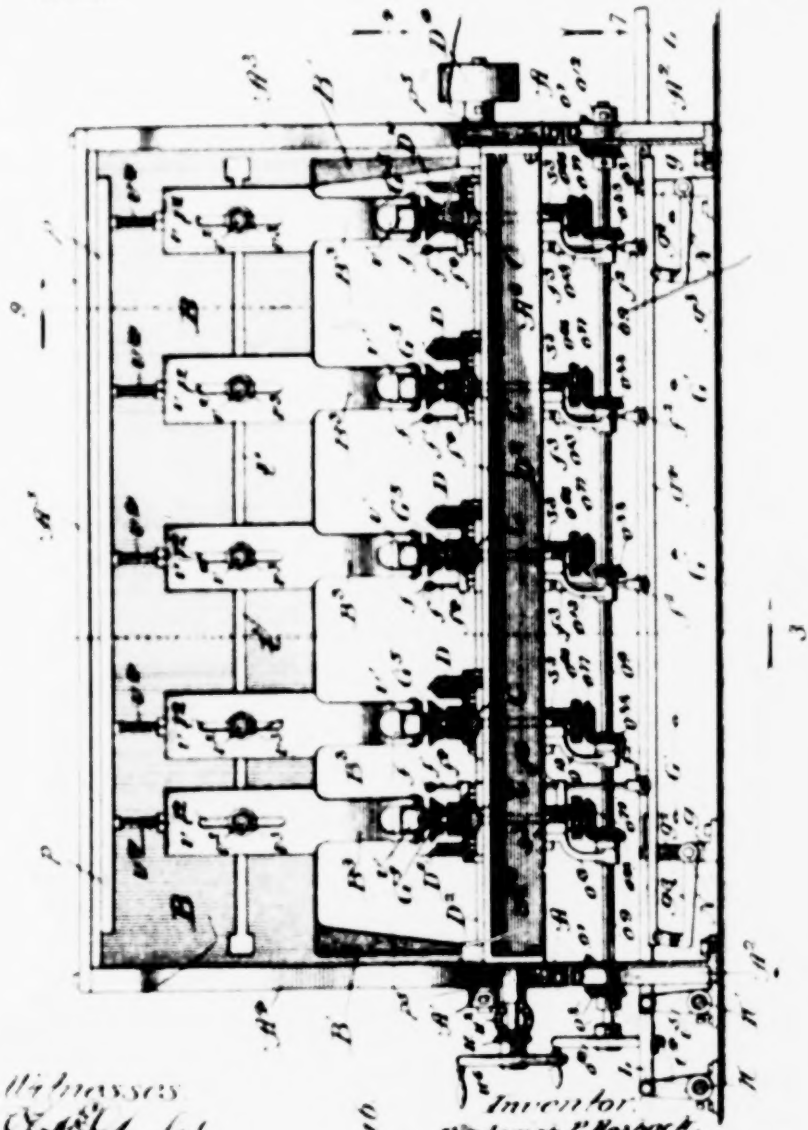
No Model. 14 Sheets—Sheet 6



Witnesses
Chas. E. Ingalls
John A. Wilkie

Inventor
Frederick P. Rosback
by Dyrenforth & Dyrenforth
Attys.

1473-1474

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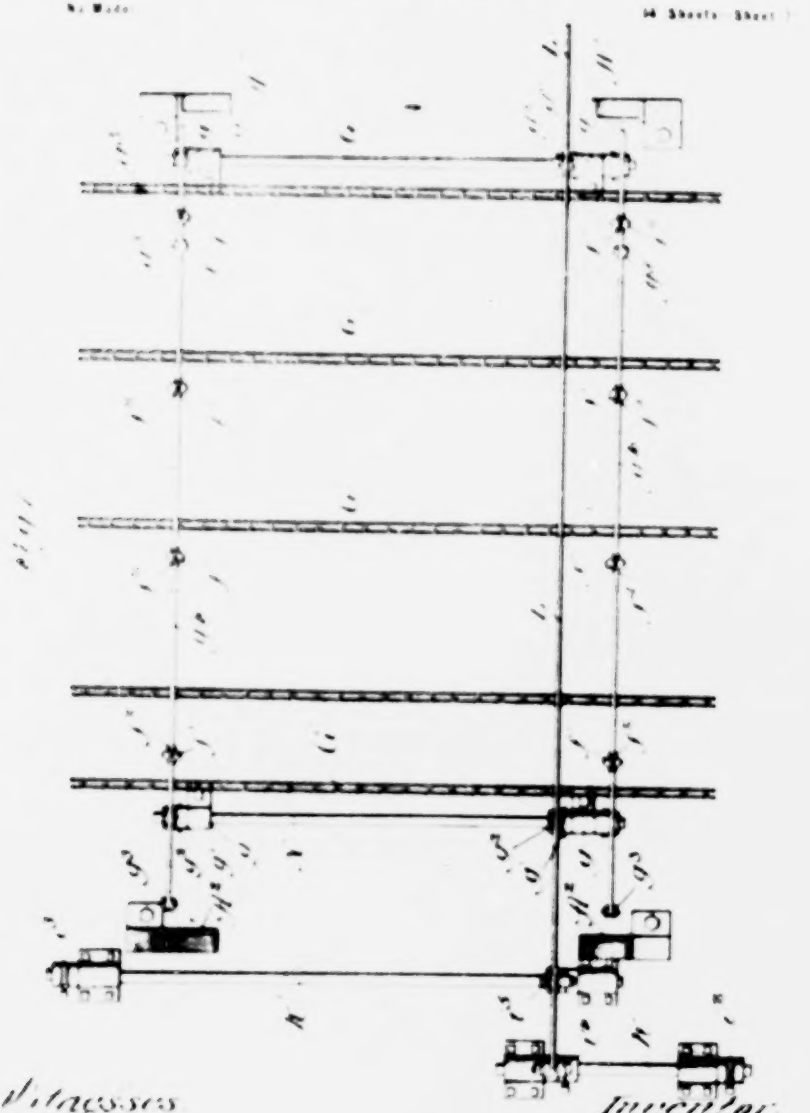
F. P. ROSBACK.

MACHINE FOR STEP MITERING BOX BLANKS.

(No Model.) (4 Sheets-Sheet 1.)



Witnesses:
Chas. E. Hoyt
Chas. S. Wilcox

Inventor:
Frederick P. Rosback,
By Dyrenforth & Dyrenforth
Attys.

1475-1476

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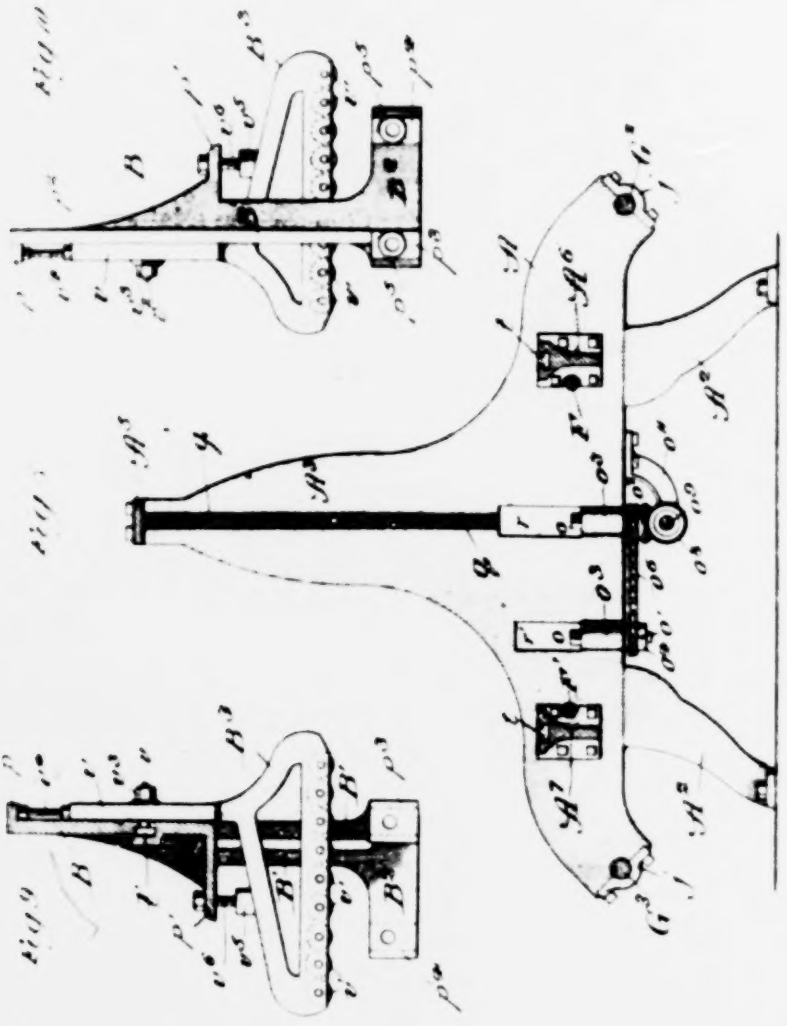
F. P. ROSBACK.

MACHINE FOR STEP MITERING BOX BLANKS

Application filed Dec. 28, 1896.

No Model. 14 Sheets—Sheet



Witnesses.

Inventor:
Frederick P. Rosback,
By Dyrenforth & Dyrenforth,
Attys.

1477-1478

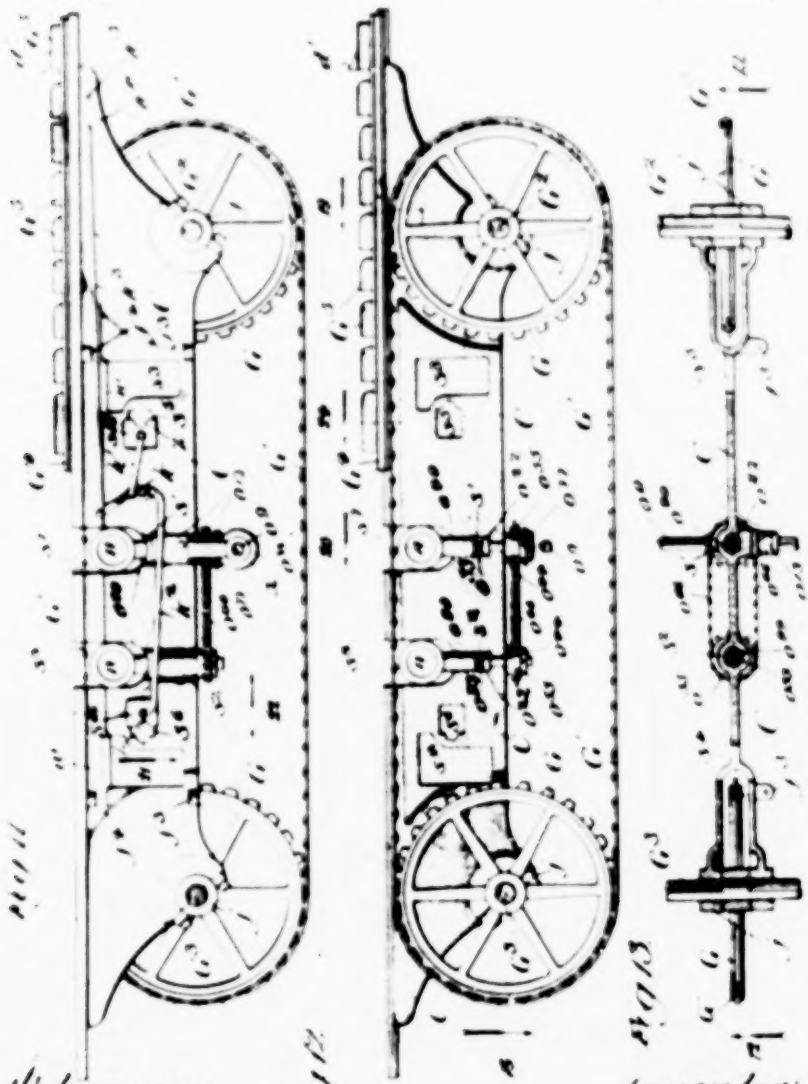
No. 623,258 Patented Apr. 18, 1899.

F. P. ROSBACK.

MACHINE FOR STEP MITERING BOX BLANKS.

(Application filed Dec. 22, 1898.)

(No Model.) 14 Sheets—Sheet 5.



Witnesses:
Carl E. Mayhew
Edw. S. Miller

Inventor:
Frederick P. Rosback.
By Dyrenforth & Dyrenforth
Atty's.

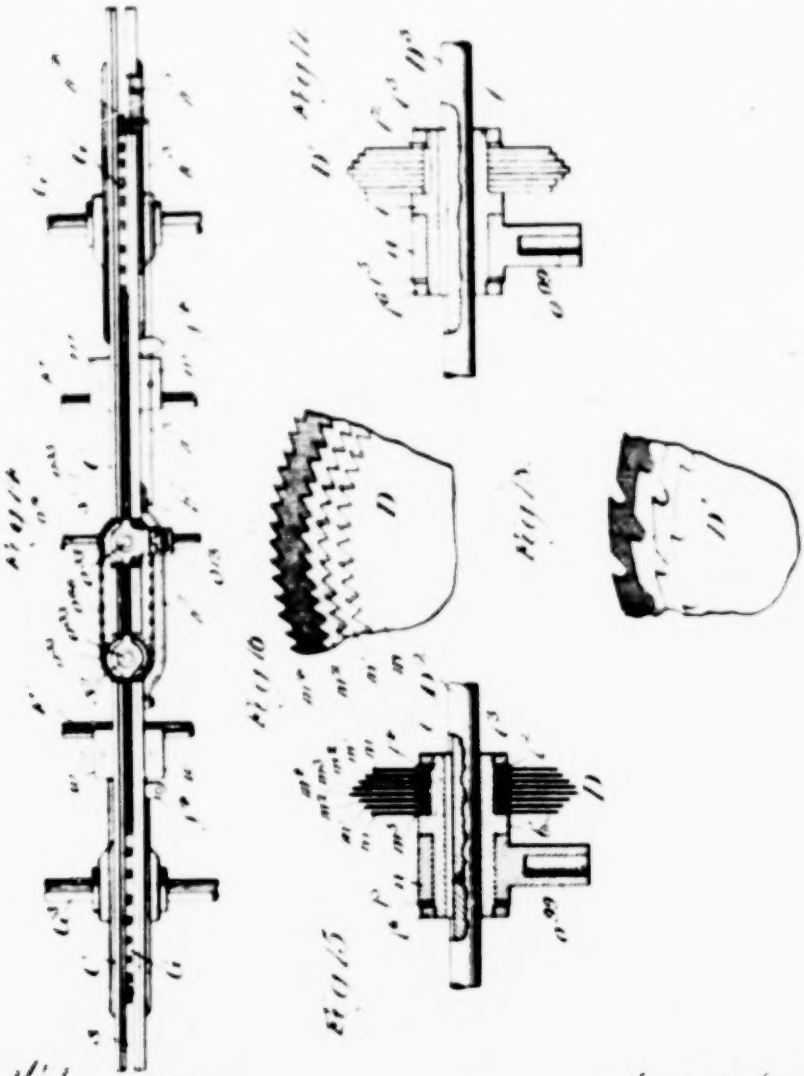
No. 623,258 Patented Apr. 18, 1899

F. P. ROSBACK.

MACHINE FOR STEP MITERING BOX BLANKS

Application filed Dec. 22, 1896.

No Model. 14 Sheets—Sheet 10.



Witnesses:
Chas. E. Langhorst
Wm. S. Hill

Inventor:
Frederick P. Rosback,
By Dyrenforth & Dyrenforth,
Attys.

1481-1482

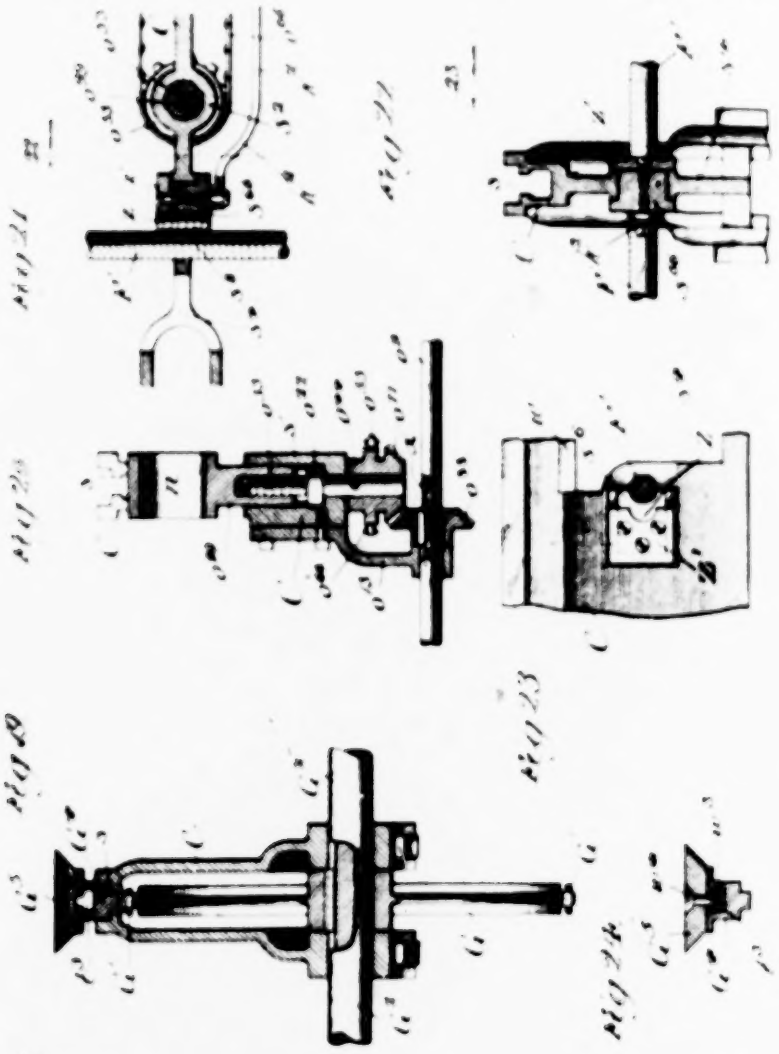
No. 623,238 Patented Apr. 18, 1899

F. P. ROSBACK

MACHINE FOR STEP MITERING BOX BLANKS

Application filed Dec. 28, 1898.

No Model. 14 Sheets—Sheet 4.



Witnesses

Inventor

Frederick P. Rosback

by Dyrenforth & Dyrenforth,

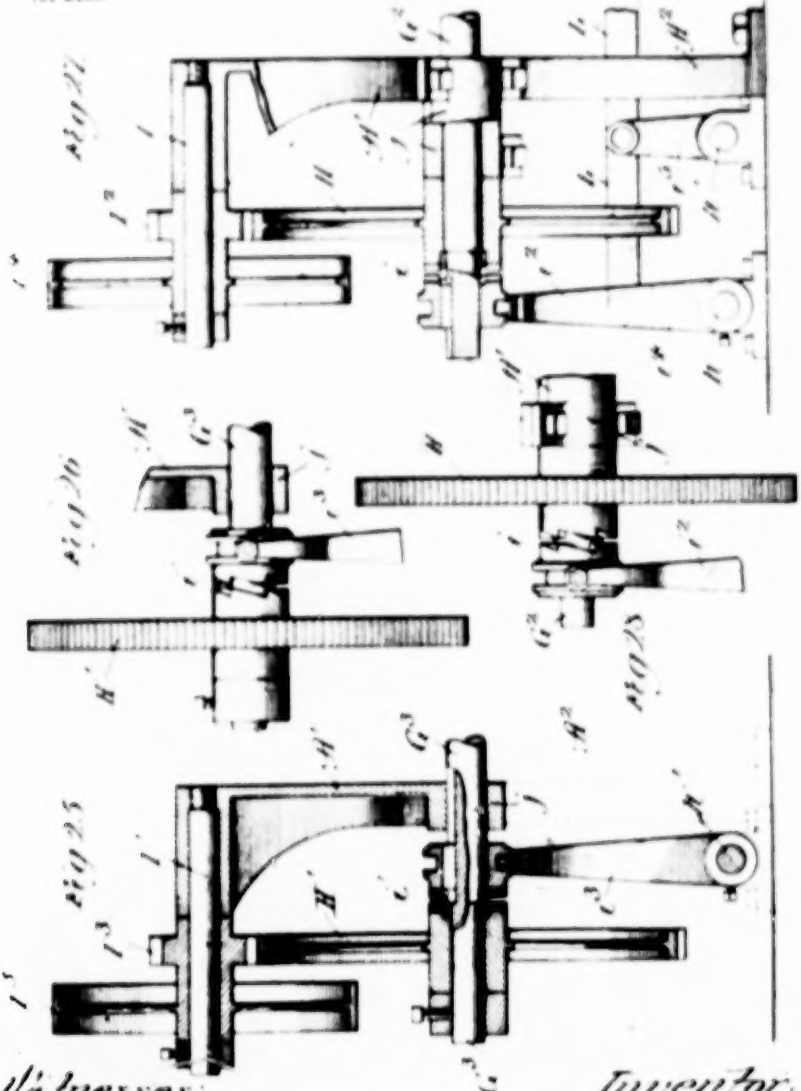
Attys.

No. 623,258. Patented Apr. 18, 1899.

F. P. ROSBACK.

MACHINE FOR STEP MITERING BOX BLANKS.

(No Model.) 14 Sheets—Sheet 12.



Witnesses:
Frank E. Ingold.
Jute S. White.

Inventor:
Fred. P. Rosback,
By Dyrenforth & Dyrenforth
Attys.

1485-1486

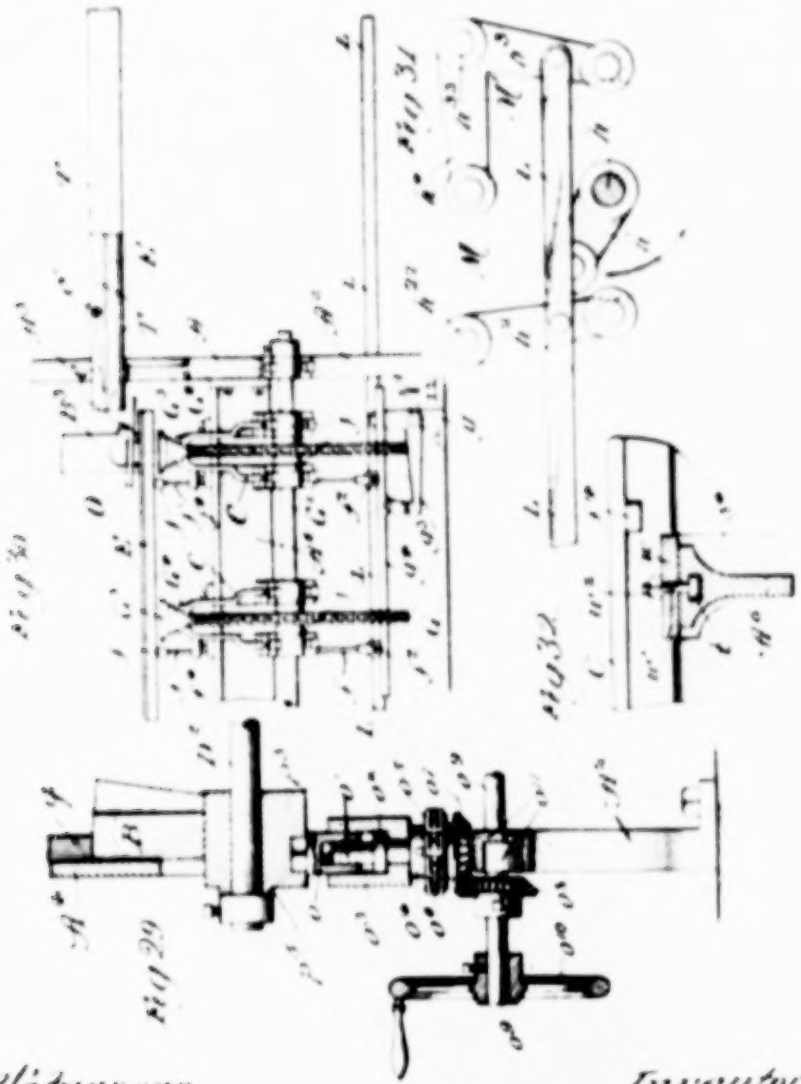
No. 623,258 Patented Apr. 18, 1899

F. P. ROSBACK

MACHINE FOR STEP MITERING BOX BLANKS

Application filed Dec. 20, 1898.

No Model. 14 Sheets—Sheet 13.



Witnesses:
Chas. E. Langdell
Julia A. Hoyt

Inventor:
Frederick P. Rosback.
By Crosby & Crosby,
Attys.

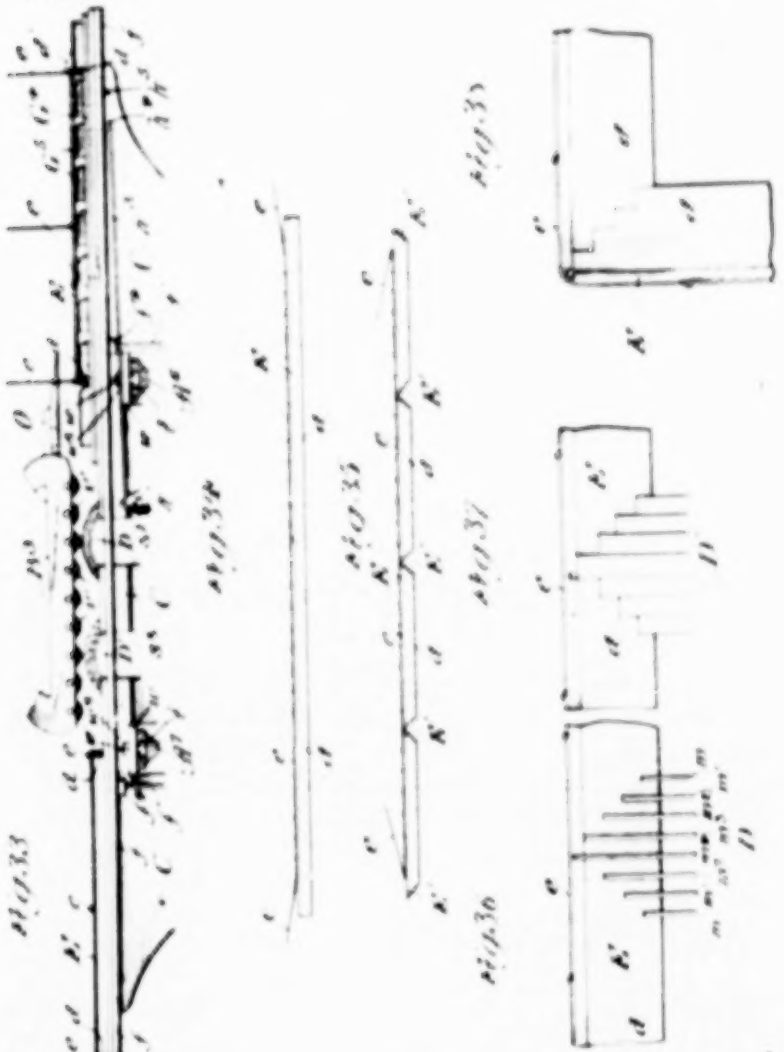
No. 623,258 Patented Apr. 18, 1899

F. P. ROSBACK.

MACHINE FOR STEP MITERING BOX BLANKS

Application filed Dec. 22, 1898.

(No Model.) 16 Sheets—Sheet 14.



Witnesses:

Inventor:

Frederick P. Rosback.

By Dyrenforth & Dyrenforth.

Attys.

[fol. 1489] United States Patent Office

Frederick P. Rosback, of Chicago, Illinois, Assignor to William P. Healy, of Same Place

Machine for Step-mitering Box-blanks

Specification Forming Part of Letters Patent No. 623,258, Dated April 18, 1899

Application filed December 22, 1898. Serial No. 700,019. (No model.)

To all whom it may concern:

Be it known that I, Frederick P. Rosback, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Machines for Step-Mitering Box-Blanks, of which the following is a specification.

The invention relates to an improved machine for step-mitering box-blanks at suitable intervals to adapt them to be bent to form the corners of angular boxes with the opposite sections of each set of step-mitered cuts intermeshing. The box-blank, for step-mitering which more particularly the present machine is devised, comprises a thin sheet of wood reinforced on opposite sides, respectively, with parallel longitudinally-extending cleats and wires, the cleats, sheet, and wires being fastened together at intervals, as with staples driven through the sheet into the cleats and over the wires to straddle them. A top plan view of the blank is shown in Fig. 4 and an edge view in Fig. 34 of the drawings. The action of this machine is that of producing the step-mitered cuts in the cleats and under surface of the sheet of a blank fed to it and also to trim the blank to the proper length.

The present machine is an improvement on that forming the subject of my former patent, No. 609,630, dated August 23, 1898.

Referring to the accompanying drawings, Figure 1 is a view in elevation of the machine regarded from one side; Fig. 2, a similar view of the machine regarded from the opposite side; Fig. 3, a longitudinal section taken at the line 3 on Fig. 6 and viewed in the direction of the arrow;

Fig. 4, a section taken at the line 4 on Fig. 3 or at the line 4 on Fig. 6 and viewed in the direction of the arrows; Fig. 5, a section taken at the line 5 on Fig. 3 and viewed in the direction of the arrow; Fig. 6, a section taken at the line 6 on Fig. 1 and viewed in the direction of the arrow; Fig. 7, a section taken at the line 7 on Fig. 6 and viewed in the direction of the arrow; Fig. 8, a section taken at the line 8 on Fig. 5 and viewed in the direction of the arrow; Fig. 9, a section taken at the line 9 on Fig. 6 and viewed in the direction of the arrow; Fig. 10, a view in elevation of the parts illustrated in Fig. 9, but regarded from the opposite side; Fig. 11, a view in side elevation of one of the several opposite end bifurcated bed-rails of the machine with the mechanism carried by it, but omitting the cross-girders and disk-clusters and their shafts; Fig. 12, a section of the same, taken at the line 12 on Fig. 13 or at the line 12 on Fig. 14 and viewed as indicated by the arrows, but omitting the half-nuts for adjusting the bed-rail; Fig. 13, a section taken at the line 13 on Fig. 12 and viewed in the direction of the arrow; Fig. 14, a partly-broken top plan view of the mechanism illustrated in Fig. 11; Fig. 15, a broken view showing one of the cutting-saw clusters in position on their vertically-adjustable supporting-shaft; Fig. 16, a broken view, in side elevation, of one of the cutting-saw clusters; Fig. 17, a view like that presented by Fig. 15 of one of the chipping-disk clusters, on their vertically-adjustable shaft; Fig. 18, a broken view, in side elevation, of a chipping-disk cluster; Fig. 19, a section taken at the line 19 on Fig. 12, viewed in the direction of the arrow and enlarged; Fig. 20, a section taken at the line 20 on Fig. 12, viewed in the direction of the arrow and enlarged; Fig. 21, a broken section taken at the line 21 on Fig. 11, viewed in the direction of the arrow and enlarged; Fig. 22, a section taken at the line 22 on Fig. 11 and enlarged or at the line 22 on Fig. 21 and viewed in the direction of the arrows; Fig. 23, a section taken at the line 23 on Fig. 22 and viewed in the direction of the arrow; Fig. 24, a section taken at the line 24 on Fig. 12, viewed in the direction of the arrow and enlarged; Fig. 25, a broken section taken at the line 25 on Fig. 1, viewed in the direction of the arrow and enlarged; Fig. 26, a broken view showing the carrier-feed clutch device in elevation; Fig. 27, a broken section taken at the line 27 on Fig. 1, viewed in the direction of the arrow and enlarged;

Fig. 28, a view like that presented by Fig. 26 of the carrier-return clutch device; Fig. 29, a section taken at the line 29 on Fig. 1, viewed in the direction of the arrow and enlarged; Fig. 30, a broken view in end elevation of the mechanism at the right-hand side of the front of the machine [fol. 1490] showing the relative position of the feed guide to the step-mitering machine; Fig. 31, a view in the nature of a diagram of the automatic carrier feed and return governing mechanism; Fig. 32, an enlarged sectional elevation showing a detail of construction relating to the adjustment of a bed rail; Fig. 33, a broken view, in sectional elevation, of the machine, showing two blanks respectively in position after delivery past and previous to delivery to the saws; Fig. 34, an edge view of a box blank before its subjection to step-mitering; Fig. 35, a similar view of the same after it has been step-mitered; Fig. 36, an enlarged broken view showing a cluster of the cutting saws and the relative position of a box-blank as it is fed thereto; Fig. 37, a broken view showing a cluster of chipping-disks and the relative position of a blank being fed thereto; and Fig. 38, an enlarged broken view of one corner portion of a box, showing how a step-mitered blank is bent to form the corner.

The frame of the machine comprises the two parallel sides A and A′, provided with legs A^2 toward their opposite ends and with corresponding central upright cheeks A^3 and A^4 rigidly connected together across the machine by a bar A^5, bolted to their upper ends, and the sides are further reinforced by the cross-girders A^6 and A^7, extending between them respectively toward their opposite ends and provided in their upper sides with longitudinal slots t t of inverted T-shape in cross-section and enlarged for the purpose of bolt-head insertion at their opposite ends.

In the inner sides of the cheeks A^3 A^4 are formed, to extend from their upper ends to rectangular openings r in the centers of the respective frame sides, central vertical guide-grooves q q, and back of these openings in the sides A A′ are similar openings r'.

B is a cross-head in the form of a plate having a flange p (extending forward along its upper edge, a ledge p' extending backward from its lower edge, and a slot t' of T shape in cross-section formed in its front side and enlarged at its opposite ends, and at the opposite ends of the plate B are legs B′ B′, provided along their outer sides with verti-

cal ribs p^6, extending to the top of the plate and confined in the grooves q, Fig. 5. These legs terminate at their lower ends in shoes B^2 B^2, each provided on its outer side, respectively, near the heel portion and the toe portion with rectangular lugs p^7 p^7, forming journal-bearings for the rotary saw-shafts, as hereinafter described, and surrounded by bosses p^8. These lugs extend into the openings r and r' in the frame sides, and the cross-head B is supported at them in a vertically-adjustable manner, hereinafter described. At intervals along the cross-head B are adjustably supported presser-feet B^3, carrying antifriction-rollers r^7 in their bifurcated lower ends, the feet having upright shanks r^8, containing vertical slots t^6, through which pass bolts r^9, confined in the cross-head slot t' and carrying nuts r^{10}, whereby on loosening a nut a presser-foot may be slid on its supporting-bolt in the slot to vary its position. Each presser-foot is set against vertical upward displacement by a set-screw device r^4, confined at its opposite ends between the flange p and upper end of the shank r^8, and to render rigid and prevent tilting of the presser-foot from the level position its base should always occupy a head r^5 bears against it toward its rear end, the head being confined by a set-screw r^6, depending through the ledge p'.

C C are the longitudinal bed-rails, provided in desired number. (Five are employed in the machine, as illustrated.) A presser-foot is provided for each bed-rail, the construction of which is most clearly shown in Fig. 13. Each rail has extending throughout its entire length a T-socket s in its upper side, Fig. 22, and involves an intermediate web portion having the enlargements s' and s^2, affording perpendicular journal-bearings, and the transverse openings s^3 s^4, adjacent to which, respectively, are the openings of s^5 s^6, having half-round concave outer ends, and the end portions of each rail are bifurcated and provided at their backwardly-inclined extremities with journal-bearings for the shafts of the sprocket-wheels of the chain-feed hereinafter described. In each rail C are also provided the vertical recesses s^7 s^8, extending from the top of the rail and respectively coinciding with the enlargements s' s^2. These bed-rails are supported on the cross-girders A^6 A^7, which pass through them at the openings s^3 s^4, and are each adjustably fastened to its supporting-girder, as most

clearly shown in Fig. 32, by bolts o^{7}, confined in the girder-slots t and passing through lateral flanges w at opposite sides of each rail, where it intersects with a girder, the bolts being fastened by nuts o^{8}. When the nuts o^{8} of a bed-rail are loosened, it may by sliding it be moved bodily with relation to an adjacent bed-rail, and screw-and-nut mechanism for so moving it is provided, as hereinafter described.

D^{2} is the rotary shaft for the clusters of cutting-saws D, and D^{3} is a similar shaft for the clusters of chipping-disks D^{4}. The shaft D^{2} is driven from a belt-pulley D^{5} on one end, and the shaft D^{3} is driven from a belt-pulley D^{6} on one end, and the shaft D^{3} is driven from a belt-pulley D on the opposite end. These shafts extend transversely across the machine, being respectively journaled at their ends in the bearings afforded by the lugs p p^{1} on the shoe-ends of the cross-head legs B' and being also journaled between their ends at the recesses s^{2} s^{3}, provided in the bed-rails C, thus crossed by the saw-shafts. In the base of each bearing p^{2} and p^{1} there is confined at its squared head, against rotation (as shown of the bearing p^{2} in Fig. 29) a nut o, engaged by the threaded end of a stem o', rotatably confined at its shoulder o^{3} in a socket o^{4}, into which the nut enters, the socket being formed in the frame side. Underneath the socket is a collar o^{5}, fastened to the stem and [fol. 1491] carrying a sprocket o^{6}. The sprockets on the two stems j under the bearings p^{2} and p^{1} at each side of the machine are geared together by an endless chain o^{9}, and the stem o' under each bearing p carries on its lower end a miter o^{7}, meshing with a similar miter o^{8} on a rotary shaft o^{9}, equipped with a hand-wheel o^{10} on one end and journaled toward its opposite ends in bracket-arms o^{11}, supported from the bases of the frame sides A A'. The end of the shaft o^{9} which projects beyond the frame side A carries a collar o^{12} to confine the shaft against longitudinal movement, Fig. 6.

The shaft o^{9} contains a longitudinal groove x for keys, and it is supported at intervals between its end bearings in brackets o^{13}, fastened to depend from the sides of the bed-rails C. A miter o^{15} abuts against the bearing portion of each bracket o^{13} and is keyed on the shaft o^{9}. In each of sockets s' s^{2}, forming enlargments in the web portion of

each bed-rail C', is slidingly confined a nut o^{10}, Figs. 15, 17, and 20, terminating at its upper end in a ring n, these rings being located within the planes of the recesses s^5 s^5 in the bed-rails. The threaded end of a vertical stem o^{11} enters each nut o^{10} and is rotatably confined in the socket of that nut by a shoulder o^{12}, and the lower projecting end of each stem o^{11} has fastened to it a collar o^{13}, carrying a sprocket o^{14}. On the lower end of the threaded stem in each socket s' there is provided on the collar o^{13} a miter o^{15}, meshing with an adjacent miter o^{16} on the shaft o^{17}, and the sprockets o^{14} on the stems o^{11} of each pair of the sockets s' s^2 are geared together by a chain o^{18}.

The cutting-saw shaft D^4, in addition to being journaled at p^2 p^3, passes through and finds bearing (through indirect, as will hereinafter appear) in one series of the rings n, extending across the machine in the recesses s^5, and the chipping-disk shaft D^5, in addition to being journaled at p^4 p^4, passes through and finds bearing in the same way in the other series of rings n in the recesses s^5.

From the foregoing it will be apparent that by turning the shaft o^{17} at the hand-wheel o^{19} the following adjustments ensue: Depending on the direction of turning the shaft the four screw-stems o' will be turned correspondingly to raise or lower the nuts o, and accordingly move the cross-head B up or down, and with it the presser-feet B^3 it carries and the cluster-shafts D^2 D^5, journaled in the bearings p^3 p^4, resting on the nuts o, and the gearing, with the shaft o^{17} of the screw-stems o^{11}, carrying the two intermediate series of bearing-rings n, supporting the two cluster-shafts, causes turning of the shaft o^{17} to move these rings correspondingly with the bearings p^3 p^4, whereby all the bearings for the two cluster-shafts are correspondingly adjusted by turning the shaft o^{17} to adjust the cluster-shafts equally throughout. Obviously this adjustment does not affect the relations between the presser-feet and disk clusters, but only the distance between the bases of the presser-feet and bed of the machine afforded by the tops of the bed-rails C' to raise the presser-feet for the accommodation below them on the bed of thicker blanks and lower them to contact with thinner blanks, the disk clusters being raised or lowered accordingly to cut and chip, respectively, higher or lower,

as the case may be, for the thicker or thinner material to be step-mitered.

At intervals on the shaft D are the clusters D of circular cutting saws of the form most clearly shown in Figs. 15 and 16. Each of the clusters D between the end clusters (which are distinguished as D^1) consists, preferably, of eight saw-disks, the two outer ones m being of the same diameter, the two next inner ones m' being of slightly greater diameter, the two next ones m^2 being of still greater diameter, and the two central ones m^3 m^3 being one of slightly greater diameter than the other and each of greater diameter than the saws m^2. The saw clusters D at the opposite ends of the shaft are shown to be composed of five of the disks m, m', m^2, m^3, and m^3, with the disk of greatest diameter outermost in each case and of materially greater diameter than that of the largest disk of a cluster D for cutting through and trimming the opposite ends of the blank. The saw clusters D D^1 produce the initial saw-cuts for step-mitering a blank E and engage the blank, as indicated most plainly in Fig. 36. The saw-disks of each cluster thereof are separated by interposed collars m^4, Fig. 15, which, with the disks, surround a sleeve l, keyed to the shaft D in a manner to permit it to be slipped longitudinally thereon, but to rotate with it, and the cluster is confined between a rigid shoulder l' on the sleeve between its ends and a washer l^2, secured by a nut l^3, a key l^4 serving to connect the saws and the collars m^4 rotatably with the sleeve. That portion of each sleeve l at the other side of the rigid shoulder l' from that carrying the saw-disks enters a ring n, confined between the rigid shoulder and a washer l^5, secured by a nut l^6.

On the shaft D, at intervales to coincide with the clusters D D^1, are the clusters D^2 of chipping-disks, each consisting of seven toothed disks of the relative diameters illustrated in Figs. 17 and 18 to attack the blank, as indicated in Fig. 37, and chip out the wood between the cuts made by clusters D D^1, and produce step-miters E^2, as shown in Fig. 35. The chipping-disk clusters at the ends are distinguished as D^{2a}, as they each involve only four disks. Each cluster D^2 D^{2a} is fastened to the shaft D to rotate with it, but permit of being slid for adjustment

lengthwise thereof by means (shown in Fig. 17) like those employed for fastening the saw clusters—namely, a sleeve l, keyed to the shaft and in which the cluster is keyed and confined between a flange l' and a washer l^2, secured by a nut l^3, the sleeve extending through the ring a, through which the shaft D passes and being confined between the [fol. 1492] sleeve-flange l' and a washer l^4, secured by a nut l^5.

Another adjustment is provided in the machine for the cutting and chipping clusters to bring them or certain of them closer together or separate them farther apart on their respective shafts, according to the relative positions in a blank in which the step-miters are to be produced for a square box or one longer in one direction or on one side than the other. The mechanism shown for effecting this adjustment involves the following construction:

F F' are rotary shafts threaded throughout and journaled at their opposite ends, respectively adjacent to the inner sides of the girders A^0 A^1 in the frame sides. These shafts are stopped against longitudinal movement, as clearly shown in Fig. 5, and carry at their ends projecting beyond the frame side A miters u and u', respectively meshing with miters u^2 and u^3 on the opposite ends of a rotary shaft u^4, journaled in bearings u^5 u^6, extending from the outer side of the frame side A. The screw-shaft F carries on one end a hand-wheel u^6. In the openings s^5 s^6 of each bed-rail C, Fig. 11, are provided, respectively, the sliding half-nuts s^{55} and s^{56}, each containing a half-round threaded recess z in its end adjacent to the screw-shaft. Each of these nuts, the construction of which is shown clearest in Figs. 21 to 23, is flanged on one side to overlap the opening containing it at one side of the rail C and provided with a cap z', fastened to its opposite side, there to overlap and thus confine the half-nut slidingly in place. Between each pair of the nuts s^{55} s^{56} on one side of the web of each bed-rail C is fulcrumed, between its ends, a lever k, connected from one end by a link k^2 with the nut s^{55} and from its opposite end by one arm of a bell-crank k' with the nut s^{56}, the other arm of the bell-crank having connected with it one end of a rod or handle k^3, the free end of which is bent to a right angle, there to enter either of two holes k^4 or k^5, formed one in advance of the other in the side of

the respective bed rail near the front end of the machine, Fig. 3.

When the nuts e^3 e^3 are out of engagement with the screw-shafts, turning them by turning the hand-wheel a^6 will not cause them to produce any action. When, however, it is desired to adjust any pair of clusters D D' with relation to another pair thereof on their shafts, the respective rod k^3 is drawn, after freeing its outer end from the opening k^4, to bring it coincident with the opening k^5 into which it is inserted to retain it. Thereby the lever k is turned to move the nuts e^3 e^3, through its connections with them, into mesh with the shafts F F', when turning them in one or the other direction at the hand-wheel a^6 moves the respective rail C' (the nuts a^{10} of which have been preparatorily loosened to be tightened again after the adjustment) accordingly along the girdles A' A'. The connection of the cluster-carrying sleeves l with the rings s and their rigid connection with the rail cause the described movement of the latter to move correspondingly with it the sleeves and the clusters thereon. Thus adjustment of the clusters D D' may be accomplished to a small fraction of an inch.

The mechanism for feeding across the clusters a blank to be step-pointered carries it slowly through the machine and then makes a quick return for another blank to be acted on. This mechanism, as shown, involves the following-described construction: Journaled at j j in the opposite bifurcated ends of each bed-rail C' and the ends of the frame sides A A' are longitudinally-grooved rotary shafts G^2 G^2, extending entirely across the machine and carrying at corresponding ends, respectively, the cog-wheels H and H'. In the opposite bifurcated ends of each bed-rail are keyed on the shafts G^2 G^2, to rotate with them, but to permit of their sliding thereon with the adjusting movement described of the bed-rail, sprocket-wheels G, connected by an endless chain G'. A portion of each chain passes through the base portion of the longitudinal socket s of a bed-rail C' and has fastened to it a rigid bar G^4, the shape of which in cross-section is shown in Figs. 6 and 24. This bar is provided in its upper expanded side with a central T-slot t^3, in which are confined by nuts x^3 screw-bolts x^4, having their heads countersunk in blocks G^5,

which the bolts thus adjustably secure to the bar G^4. The chains G' on their sprocket-wheels, with the bars G^4 and blocks G, thus form a carrier for the blanks to be step-mitered, having its path on the bed-rails C and extending across the shafts D D and clusters thereon.

On stub-shafts I I' respectively journaled on the opposite ends of the frame side A are fastened pinions I^2 I^3, meshing with the gear-wheels H H' and belt-pulleys I^4 I^5, the latter having a straight belt connection I^{55} (represented in Fig. 1) with one drive-shaft I^2 for the feed or advance of the carrier, and the former having a cross-belt connection I^{44} with another drive-shaft I^3 for the return of the carrier. The wheel H, by its gear connection with the drive-shaft I^2, is continually driven in one direction, but idly on its shaft G^2 until clutched thereto, as hereinafter described, and the wheel H', by its gear connection with the shaft I^3, is continuously driven in the same manner in the opposite direction. On the shaft G^2 is a clutch *i* and on the shaft G^3 is a clutch *i'*, each clutch comprising a stationary member on the hub of a gear-wheel and a sliding member on the respective shaft carrying the gear-wheel, the clutch *i* being at the outer side of the frame side A and the clutch *i'* at the inner side thereof.

K is a rock-shaft journaled in suitable bearings near the base of the machine to extend lengthwise thereof and carrying at one end an arm i^2, engaging with the movable member of the clutch *i*, and K' is another rock-shaft similarly journaled and carrying on one end an arm i^3, engaging with [fol. 1423] the movable member of the clutch *i*. On the two shafts K and K' are provided, coincident with each other, the upward-projecting arms i' i^5, Fig. 6, pivotally connected at their upper ends by a trip-bar L, extending across the base of the machine beyond the side A' thereof to the automatic clutch-actuating mechanism M, (illustrated in Fig. 31,) and which may be located in any convenient position relative to the step-mitering machine. This mechanism, as illustrated, comprises a constantly-rotating shaft *h*, carrying a crank-arm *h'*, provided with a thimble at its free end, a lever h^2, fulcrumed at h^{22} at one end, pivotally connected between its ends with the trip-lever L, and carrying at its free end a thimble extending adjacent to that on the free end of the crank *h'*, and a bell-

crank M′, fulcrumed at its angle at h^{33}, with one arm h^3, pivotally connected between its ends to the adjacent end of the trip-bar, and its free thimble-equipped end extending in horizontal alinement with the free end of the lever h^2 across the path of the free end of the crank h', and with the free thimble-equipped end of its other arm h^4 extending over the shaft h in the plane between the lever h^2 and bell-crank arm h^3, adjacent to the path of the free end of the crank h'. The arrangement is such, as will be observed, that the clutches i and i' are engaged in contrary directions and also, of course, similarly disengaged. With the parts of the mechanism M in the relative positions represented in Fig. 31 both clutches are disengaged, and the mechanism of the step-mitering machine is illustrated in the condition with this position of the parts of the clutch-actuating mechanism. Therefore in the rotation of the shaft h in the direction indicated by the arrow in Fig. 31 the crank h' engages the lever h^2, then extending into its path, turning it out of the path and at the same time drawing the arm h^3 farther into the path and accordingly turning the arm h^4 out of the path. This action shifts the bar L to rock the shafts K and K′ in the same direction, thereby engaging the feed-clutch i' and throwing the loose member of the return-clutch i still farther out of engagement with its companion member, thus twice the distance therefrom that the free member of the clutch i' was initially from its companion member. This clutch engagement produces rotation of the shaft I′ to drive the shaft G^3, and thus turn all the sprockets G G in the direction to actuate the chains G′ to advance a blank E, imposed on the blocks G^5, as hereinafter described, across and beyond the clusters D D′. By that time the shaft h in its continued rotation through a half-revolution will encounter the arm h^3, extending into its path twice as far as the lever h^2 extended therein, and will throw it out, accordingly, twice the extent of the throw of that lever, thereby turning the bell-crank arm h^4 into the path of the crank h' to the same extent as the lever h^2 is shown in the path, but shifting the trip-bar I twice as far as before and in the contrary direction, thereby moving the loose member of the return-clutch i into engagement with its companion member and that of the feed-clutch i' to the extreme end of disengagement with its companion

member. This engaging of the clutch i causes the rotation of the shaft I, more rapidly rotating than the shaft I', to be imparted to the shaft G^2 to reverse the travel of the chains G' and quickly return the blank-carrier to its initial position to receive another blank to be step-mitered. A quarter-revolution of the shaft h will bring the carrier to that position when the crank h' encounters the bell-crank arm h^4, throwing it out to the position in which it is illustrated in Fig. 31, thereby returning the arm h^3 and lever h^2 to their illustrated initial positions and as the result shifting the trip-bar L far enough to turn the shaft K K' sufficiently to disengage the loose members of both clutches i i' from their companion members, bringing them to their intermediate positions, and thus stopping the travel of the carrier until at the end of the last quarter-revolution of the shaft h the crank h' encounters the lever h^2 to repeat the operation described.

Connected with the trip-bar L to be actuated by its movements is mechanism for receiving a blank E to be fed to the machine on a plane above that of the carrier, then dropping it upon the carrier to bring it into position to be step-mitered by the mechanism therefor, and after the step-mitering operation lifting the finished blank above the plane of the blocks G^5 to permit the carrier to be returned, as heretofore described, to its initial position for receiving a fresh blank.

As shown, the mechanism referred to involves the following construction: Between the legs A^2 on opposite sides of the longitudinal center of the machine and on the base upon which the machine is supported are journaled in suitable standard-bearings g the rock-shafts N and N'. On these shafts, Figs. 6 and 7, at the inner sides of a pair of the standards g nearest the front end of the machine are fastened collars g', carrying upwardly-projecting arms g^2, bifurcated at their extremities, there to embrace the trip-bar L, which seats in and is fastened to them. On the opposite ends of each rock-shaft N N' are fastened arms g^3, (shown in angular form,) each pair of which toward the front and rear ends of the machine is pivotally connected at its free end with and carries a bar g^4. At corresponding intervals along the bars g^4 there bear, with antifriction-rollers f^2 on their lower ends, vertical rods f', passing upward through guide-bearings f^3 f^4, provided in suitable posi-

tion on sides of bed-rails C, and coinciding rods f' near opposite ends of the bed-rails are rigidly connected by bars f, extending alongside of such bed-rails.

When the clutch-actuating mechanism M throws the trip-bar L in the direction, as described, for engaging the feed-[fol. 1494] clutch i', the connection of the trip-bar with the rock-shafts N N' turns them accordingly, and with them the arms g^3, to lower the bars g^4 below the planes at which they are shown in Fig. 6, thereby permitting the rods f' to drop by gravity, and carry with them the bars f, considerably below the tops of the carrier-blocks G^5. The return throw of the trip-bar L for engaging the clutch i rocks the shafts N N' in the opposite direction to turn the arms g^3 accordingly and raise the bars g^4, thereby raising the bars f high above the carrier-blocks, and the throw of the bar L, which produces, as described, the disengagement of both clutches i i', brings the bars g^4 to the positions in which they are shown in Fig. 6, wherein the bars f project slightly above the planes of the carrier-bars.

The operation is as follows: At the right-hand corner of the front of the machine is shown, Fig. 30, a guide-support T, leading transversely of the carrier in its initial position. From this guide-support the blanks E are fed to the machine automatically or by hand at proper intervals endwise, with their cleats d undermost and wires e uppermost. In sliding a blank from the support T upon the machine the free advance ends of the wires e pass under and encounter a bar e' extending across the support in their path, and are thus bent back to the condition shown out of the path of the saw clusters D^{11} at the farther side of the machine, and the opposite or rear free ends of the wires e as the blank is being fed to the saws, as hereinafter described, encounter a rigid deflector O, provided in their path on the machine, which bends the wire ends back out of the way of the saw clusters D^{11} at the adjacent side of the machine. Thus the saws are prevented from encountering the wires, which would tend to dull them.

The outermost blocks G^5 present at their inner ends a transverse line of abutments d' for the cleat d at one side of the blank E, fed across them, and the blocks are so adjusted relatively to each other that the blank will fit over a number of them, with the cleat at one of its edges coincid-

ing with the recesses between the outer end blocks and those next adjacent to them and with the cleat at the other edge of the blank coinciding with the alining recesses between two other adjacent rows of the blocks. In entering the machine the blank slides across and rests upon the series of bars *f*, then raised to receive it, as hereinbefore described, and shown in Fig. 6. The encounter which is timed to then ensue between the crank *h* and lever h^2 of the mechanism M throws the trip-bar L to engage the feed-clutch *i'* and effect lowering of the bars *f*, whereby the imposed blank is seated over the carrier-blocks, and the resultant rotation of the shaft G^3 produces travel of the chains G' and bars G^4 and blocks G^5 thereon to carry the blank under the presser-feet B^3 across the clusters in its path under rotation on their shafts. The clusters D^{11} trim the ends of the blank, and they, with the clusters D, make the cuts in the cleats and under sides of the sheet for the step-miters E', which are finished by the chipping action of the clusters D^2 D^{22}, which chip out the material between the side cuts to form the steps. On the arrival of the finished blank (then ready to be folded, as shown in Fig. 38, at the step-miter cuts to form the sides of a box) past the chipping-clusters the timing of the mechanism M produces encounter of the crank *h* with the arm h^3, thereby throwing the trip-bar L accordingly to effect raising of the bars *f* to lift the blank above the plane of the carrier-blocks G^5 and permit the latter to be returned to their initial position by the rotation in the proper direction for the purpose of the shaft G^3, produced by the throw of the trip-bar, causing engagement of the clutch *i*. Meantime the finished blank may be removed from the machine by any suitable means.

The timing of the mechanism M is such that when the carrier has been returned to its initial position the consequent engagement of the crank *h* with the arm h^4 throws the trip-bar L to disengage both clutches *i i'*, and thus stop the carrier and raise the bars *f* to the position in which they are shown for receiving another blank E to be operated upon in the manner described.

The details of construction shown and described may of course be variously modified by those skilled in the art

without departing from the spirit of the invention as defined by the claims.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a step-mitering machine, the combination with the saw and chipping-disk clusters on their rotary shafts, of a reciprocatory carrier on the machine-bed, for the material to be step-mitered, a feed-clutch for engaging the carrier-driving gear to move the carrier toward said clusters, a return-clutch for engaging said gear to move the carrier in the opposite direction, a reciprocable trip-bar connected with the movable members of said clutches to actuate them, a support for said material connected with said trip-bar to be lowered and raised by its movements to deposit the material on and lift it off said carrier and driving means engaging said trip-bar to throw it alternately in opposite directions to actuate the clutches and support, substantially as described.

2. In a step-mitering machine, the combination with the saw and chipping-disk clusters on their rotary shafts, of a reciprocatory carrier on the machine-bed, for the material to be step-mitered, said carrier comprising block-equipped endless chains on sprockets secured to rotary shafts journaled toward opposite ends of the machine, a feed-clutch and gearing for connecting one of said sprocket-shafts with its driving power to move the carrier toward said [fol. 1495] clusters, a return-clutch and gearing for connecting the other sprocket-shaft with its driving power to move the carrier in the opposite direction, a reciprocable trip-bar connected with the movable members of said clutches to actuate them, and driving means engaging said trip-bar to throw it alternately in opposite directions to actuate the clutches, substantially as described.

3. In a step-mitering machine, the combination with the saw and chipping-disk clusters on their rotary shafts, of a reciprocatory carrier on the machine-bed, for the material to be step-mitered, a feed-clutch for engaging the carrier-driving gear to move the carrier toward said clusters, a return-clutch for engaging said gear to move the carrier in the opposite direction, a trip-bar connected with the movable members of said clutches, and driving means en-

gaging said trip-bar to throw it in contrary directions for actuating said clutches, comprising a rotary drive-shaft carrying a crank-arm, a lever connected with said bar at one side of said drive-shaft, and a bell-crank having one arm connected with said bar at the opposite side of said drive-shaft, said lever and bell-crank arms extending to be engaged successively by the free end of said crank in traversing its path, substantially as described.

4. In a step-mitering machine, the combination with the saw and chipping-disk clusters on their rotary shafts, of a reciprocatory carrier on the machine-bed, for the material to be step-mitered, said carrier having endless chains on sprockets secured to rotary shafts journaled toward opposite ends of the machine, a feed-clutch on a rotary shaft geared with suitable driving power and with one of said sprocket-shafts, a return-clutch on a rotary shaft geared with suitable driving power and with the other sprocket-shaft, the sliding members of said clutches being movable in opposite directions to engage with their companion members, a trip-bar pivotally connected with arms on parallel rock-shafts carrying arms to engage said sliding clutch members, and driving means engaging said trip-bar to throw it alternately in opposite directions to actuate the clutches, substantially as described.

5. In a step-mitering machine, the combination with the saw and chipping-disk clusters on their rotary shafts, of a reciprocatory carrier on the machine-bed, for the material to be step-mitered, said carrier comprising block-equipped endless chains on sprockets secured to rotary shafts journaled toward opposite ends of the machine, a feed-clutch for engaging the carrier-driving gear to move the carrier toward said clusters, a return-clutch for engaging the carrier-driving gear to move the carrier in the opposite direction, a reciprocable trip-bar connected with the movable members of said clutches to actuate them, driving means engaging said trip-bar to throw it alternately in opposite directions to actuate the clutches, and bars supported adjacent to said chains to support said material, deposit it on and then lift it off said carrier, said bars being connected with said trip-bar to be raised and lowered by its movements, substantially as described.

6. In a step-mitering machine, the combination with the saw and chipping-disk clusters on their rotary shafts, a reciprocatory carrier on the machine-bed, for the material to be step-mitered, and its actuating-clutch devices of a reciprocable trip-bar connected with the movable members of said clutch devices to actuate them, driving means engaging said trip-bar to actuate said clutches and means for supporting said material preparatory to feeding it past said clusters, then depositing it and finally lifting it off said carriers, said means comprising rock-shafts extending crosswise of the base of the machine and connected with said trip-bar to be turned by its movements, bars supported on arms extending from said rock-shafts, vertical rods bearing at intervals on said bars to be raised and lowered with them, and bars connecting said rods in pairs and extending lengthwise of the machine, substantially as described.

7. In a step-mitering machine, the combination with a carrier for the material to be step-mitered, of the saw and chipping-disk clusters on rotary shafts geared together and journaled in vertically-adjustable bearings, a vertically-adjustable cross-head confined in the frame of the machine and carrying presser-feet depending over the machine-bed, and the end bearings for said shafts, screw-and-nut supports on the frame for said bearings and a rotary shaft geared with the screws of said supports to turn them in their nuts by turning the shaft to raise and lower said cluster-shafts and cross-head, substantially as and for the purpose set forth.

8. In a step-mitering machine, the combination with the frame supporting bed-rails at intervals and a carrier for the material to be step-mitered, of the saw and chipping-disk clusters on rotary shafts geared together and journaled in vertically-adjustable bearings, a vertically-adjustable cross-head confined in said frame and carrying pendent presser-feet and the end bearings for said shafts, intermediate bearings for said shafts supported on the bed-rails, screw-and-nut supports for said end and intermediate bearings, and a rotary shaft geared with the screws of said supports to turn them in their nuts by turning the shaft to raise and lower said cluster-shafts and cross-head, substantially as described.

9. In a step-mitering machine, the combination with the frame supporting bed-rails at intervals and having side cheeks, and a carrier for the material to be step-mitered, of a vertically-adjustable cross-head confined between said cheeks and carrying presser-feet, legs on the opposite ends of said cross-head terminating in shoes provided with journal-bearings and at which the cross-head is supported in the frame sides, saw and chipping-disk clusters on ro- [fol. 1496] tary shafts geared together and journaled in said bearings, screw-and-nut supports, for said bearings, bearings for said shafts on said bed-rails and having screw-and-nut supports, and a rotary shaft geared with the screws of said supports to turn them in their nuts by turning the shaft to raise and lower said cluster-shafts and cross-head, substantially as described.

10. In a step-mitering machine, the combination with the frame supporting the bed, a carrier for the material to be step-mitered and means in the path of said material for step-mitering it, of a cross-head supported on the frame over the bed, containing a longitudinal slot and provided with a flange along its upper forward edge and a backward-extending ledge, presser-feet carrying antifriction-rollers on their bases and provided with shanks at which they are adjustably bolted in said slot, and adjustable stops depending from said ledge to bear against the presser-feet, substantially as described.

11. In a step-mitering machine, the combination of the saw and chipping-disk clusters adjustable longitudinally of their rotary shafts, bed-rails adjustably supported on the cross-girders of the machine-frame and connected with said clusters, screw-shafts journaled in the frame to extend across said rails, nut-sections adjustably supported on a bed-rail adjacent to said screw-shafts and connected together to be moved by a single operation out of engagement with said screw-shafts or into engagement therewith to cause turning of the screw-shafts to move said rail and the clusters connected therewith, substantially as and for the purpose set forth.

12. In a step-mitering machine, the combination with the frame having cross-girders, of bed-rails bifurcated at their opposite ends and adjustably supported at intervals on

said girders, sprocket-wheels journaled in the bifurcated ends of said rails and carrying endless block-equipped chains, saw and chipping-disk clusters secured on rotary parallel shafts to rotate with and be adjustable lengthwise of them, said shafts being journaled in the frame to extend across said rails, and supported thereon and said clusters being connected with their rail-supports for adjustment with the rails, screw-shafts journaled in the frame to extend across said rails, a pair of nut-sections adjustably supported on each bed-rail adjacent to the screw-shafts and a link-and-lever connection between the members of each pair of said nut-sections, having an operating-handle for actuating it, substantially as and for the purpose set forth.

Frederick P. Rosback.

In presence of M. J. Frost, R. T. Spencer.

(Here follow side folios 1497-1500)

[fol. 1501] United States Patent Office

Frederick P. Rosback, of Chicago, Illinois, Assignor to William P. Healy, of Same Place

Feed Device for Box-blank Material

Specification Forming Part of Letters Patent No. 625,958, Dated May 30, 1899

Application Filed February 4, 1899. Serial No. 704,478. (No model.)

To all whom it may concern:

Be it known that I, Frederick P. Rosback, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Feed Devices for Box-Blank Material, of which the following is a specification.

My invention relates to an improved feed device which I have devised more especially for use (though I do not

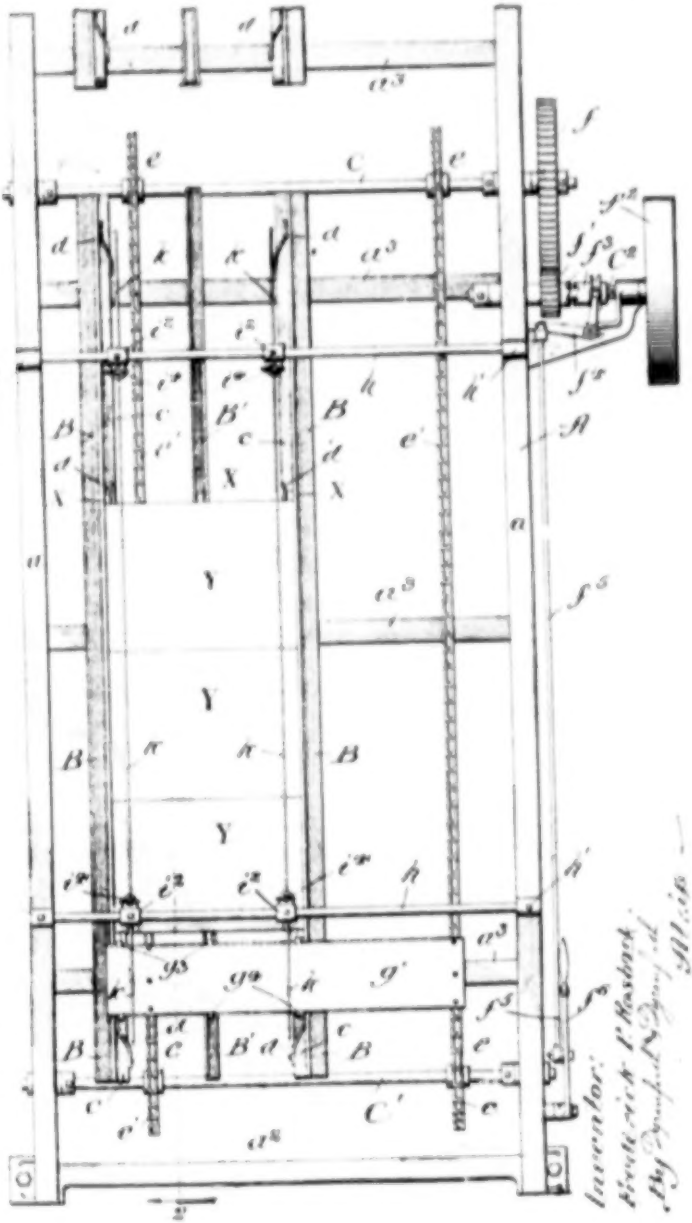
No. 625,956. Patented May 30, 1899.

F. P. ROSBACK.

FEED DEVICE FOR BOX BLANK MATERIAL.

Application filed Feb. 4, 1899.

No Model. 2 Sheets—Sheet 1.



Witnesses:

Inventor:
Frederick P. Rosback,
By Crosby & Gregory, Atty's.

No. 625,958. Patented May 30, 1899

F. P. ROSBACK.

FEED DEVICE FOR BOX BLANK MATERIAL.

(Application filed Feb. 4, 1899.)

(No Model.) 2 Sheets—Sheet 2.

Fig 1.

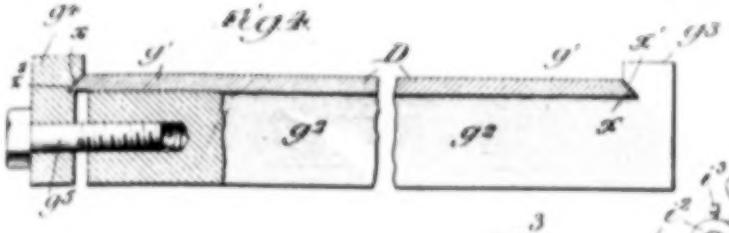


Fig 2.

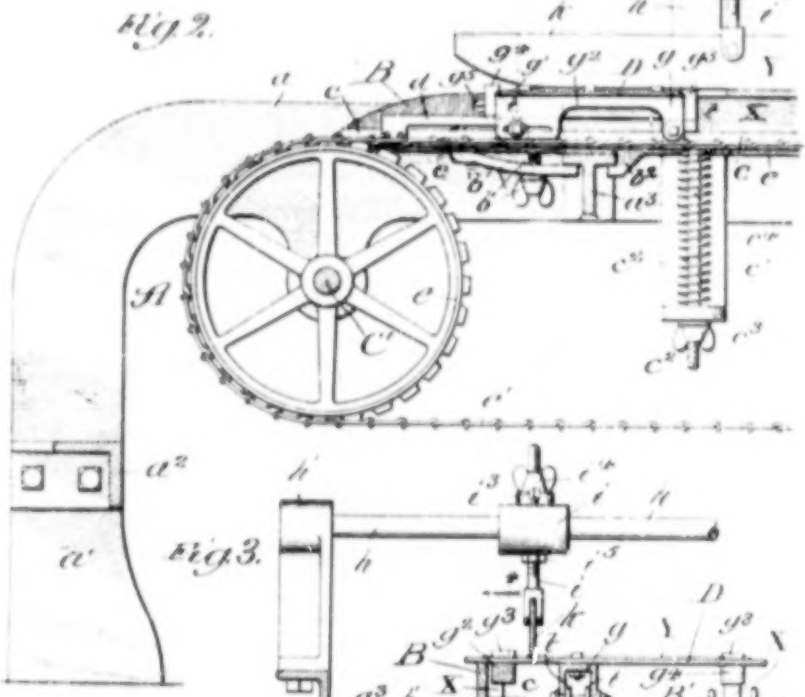
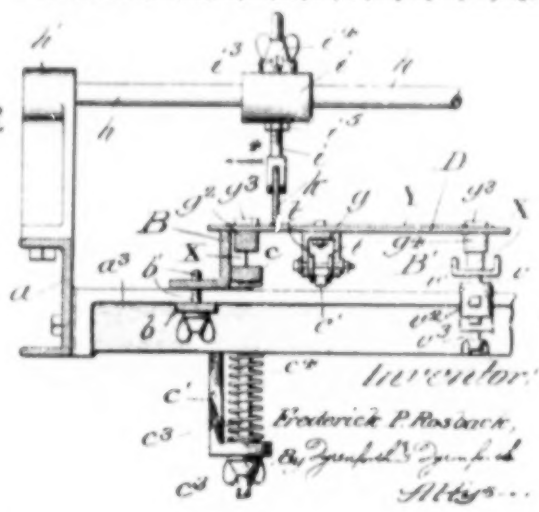


Fig 3.



Witnesses:
Chas. E. Gaylord
Julia D. Kelly

Inventor:
Frederick P. Rosback,
By Dyrenforth Dyrenforth & Dyrenforth
Attys.

limit my invention thereto) in the manufacture of boxes formed from blanks composed of sheet-wood or veneer, carrying on one side, at suitable intervals apart, parallel longitudinally-extending cleats and on the opposite side wires coincident with the cleats, the cleats, sheet, and wires being fastened together at intervals, as with staples driven through the sheet into the cleats and over the wires to straddle them.

The object of my invention is to provide an improved device for feeding the wooden sheets and cleats in their proper relative positions thereon and delivering them to a suitable machine for performing the stapling operation preparatory to the further operation of step-mitering the cleats, thereby to finish the blank and adapt it to be folded into box form.

Referring to the accompanying drawings, Figure 1 is a broken top plan view of my improved feed device; Fig. 2, a broken longitudinal section taken at the line 2 on Fig. 1, viewed in the direction of the arrow and enlarged; Fig. 3, a section taken at the line 3 on Fig. 2 and viewed in the direction of the arrow; and Fig. 4 a broken section taken at the line 4 on Fig. 3, viewed in the direction of the arrow and enlarged.

A is the frame, represented as composed of two parallel side bars *a a*, terminating at their ends in supporting-legs *a' a'*, between which they are braced by cross-bars a^2 and cross-girders a^3, shown as T-rails, extending at intervals between the side bars.

B B are the outer cleat-guides, formed, preferably, of angle-iron bars, and B' is an intermediate cleat-guide formed, preferably, of a channel-iron bar, the number of cleat-guides B' to be provided being in accordance with the number of intermediate cleats employed in the box-blank construction. Only one of the intermediate cleat-guides is shown in the present device to adapt it for feeding box-blanks, provided with two other cleats and one intermediate cleat. These cleat-guides are supported to extend parallel with the sides of the frame across the girders a^3, and they are relatively adjustable. The guides B B are each fastened to a girder where it crosses the same by a curved clamp-bar *b*, bearing at its opposite ends, respectively, against the base of a cleat-guide and the under side of the

top of the adjacent girder and fastened by a thumb-screw b', passing through it between its ends into the horizontal base of the guide B. To steady and position the guide B, a clip b^2, projecting from its base, engages with the opposite side of the head of the girder. By loosening the screws b' the guides B may be moved on their supports a^3 to any desired distance apart, at which they are secured by tightening the screws. The intermediate cleat-guide B', the top of which is below the upper edges of the guides B, has stems c' depending from its base at intervals coinciding with the girders where they carry sliding sockets c^2, through which the stems pass vertically, being held therein by set-screws c^3, and the sockets are fastened by thumb-screws c^4, bearing against the under side of the top of the adjacent girder. On loosening the screws c^4 the guide P' may be moved to any desired position relative to the outer guides B, where it is secured by tightening these screws.

At the inner side of each guide B it is supplemented by a bed-rail c, yieldingly supported from underneath to bear against the inner side of the guide and with its upper side normally on a level with the upper side of the base of the guide B'. The yielding support for each rail c is provided at intervals thereon and comprises a bracket c' depending rigidly from the base of the guide B below the planes of the girders a^2, a stem c^2 depending from the base of the bed-rail through the foot of said bracket and held by a nut c^3, screwed on the lower projecting end of the stem, and a spring c^4, confined around the stem between the bracket-foot and base of the rail. At intervals along the inner sides [fol. 150?] of the rails c are fastened clamp-springs d to bear at their free ends normally against the inner sides of the guides B.

C' and C'' are rotary shafts journaled in the sides a of the frame, near its opposite ends, and carrying sprocket-wheels e e in pairs, about which extend endless chains e' e', the whole forming an endless carrier. On the shaft C' is a gear-wheel f, meshing with a pinion f' on a stub drive-shaft C^3, suitably journaled, as shown in Fig. 1, and carrying a belt-pulley f^2 and a clutch f^3, having its loose member engaged by one end of a bell-crank f^4, the other end of which is connected with a rod f^5, extending along the frame

A to its front portion, where it is connected with an operating-handle f', turning of which in one or the other direction ships or unships the clutch. The pulley f^2 is belted to a line-shaft or the like and rotates constantly.

The more important feature of my improvement consists in a cleat-pusher D, carried by the endless chains c' to advance the cleats, with the sheet-wood material upon them, uniformly and positively to the delivery end of the feed device. This cleat-pusher, as shown, involves the following-described construction: On each chain c' is fastened, as shown of one of the chains, to ears t thereon, a yoke-shaped channel bar g, and on the outer edges of these bars is fastened, near their ends, to extend between the chains and bear on the guides B, a plate g' beveled along its forward and rear edges, as represented at x x in Fig. 4. At intervals across the base of the plate g' extend push-bars g^2, in number corresponding with the number of cleat-guides, with which they should coincide. Each push-bar terminates at its forward end in an upward-projecting head g^3, containing at its angle of junction with the body of the bar a beveled groove x' to receive and confine the correspondingly-beveled forward edge of the plate g'. The rear beveled edge of the plate fits into correspondingly-beveled grooves x^2, provided in bearings g^4, one of which is provided at the rear end of each pusher-bar and through which a bolt g^5 is passed into the respective bar g^2, as shown in Fig. 4. Thus the pusher-bars are confined or clamped between the heads g^3 and bearings g^4 upon the base of the plate g', and they may be readily moved to adjust them into respective desired coincidence with the cleat-guides D D' upon loosening the bolts g^5.

Beams are also provided to hold down against the cleats and prevent buckling or disarrangement of the sheet material imposed thereon, as hereinafter described. The means referred to are shown as involving the following-described construction: In bearings h' h', fastened in pairs to the side bars a of the frame A, at opposite sides of its transverse center, are supported rigidly rods h h. On these rods are slidingly supported at their sleeve portions i^2 and fastened in their adjusted position by set-screws i^3, passing through the sleeve portions, vertical socket pieces i, through which depend threaded stems i', shown sustained by wing-

nuts i' on their proper projecting ends and held to resist upward rise, preferably, by nuts i on their lower projecting portions. Each pair of the stems i' carries a presser-bar k, in the form of a thin metal bar having its end portions rounded at their lower edges, as shown in Fig. 2, the bar extending parallel with and adjacent to a cleat-guide B.

The guides B B' may terminate just beyond the shaft C or may there be only interrupted, as represented in Fig. 1, to permit the passage of the pusher device toward its return movement in the travel of the endless chains.

The operation is as follows: With the adjustable parts arranged according to requirement, cleats X are inserted endwise from the end of the feed device to which the shaft C' is adjacent upon the bed-rails c, between the clamping-springs d and adjacent sides of the guides B, and a cleat is similarly inserted into the intermediate channel-guide B', and sheets Y of veneer are imposed upon the cleats with their edges confined between the vertical sides of the outer guides B. The cleats and sheets are placed in position, as described, while the machine is at rest. In the inserted positions of the cleats their rear ends are in the paths of the pusher-bars g' of the cleat-pusher D, whereby when the machine is started, by throwing in the clutch f to cause the shaft C to be turned by the constantly-rotating pulley f' the travel of the chains carries the cleat-pusher against the cleats and advances them to the delivery end of the feed device and with them the sheets Y, abutting one against the other. The sheets are held by the presser-bars k in sufficient frictional contact with the cleats, owing to the extent of the rough contacting-surfaces of the cleats and sheets, to be carried by the movement of the cleats, this frictional engagement not being lessened by the contact with the sheets of the bearing-bars k, because their lower contact edges are very narrow and are or become by use polished to a degree which avoids any friction resistance from them against the sheets.

What I claim as new, and desire to secure by Letters Patent, is —

1. In a feed device for box-blank material, the combination with a frame and an endless carrier thereon, of cleat-guides supported on the frame and relatively adjustable

thereon, and a cleat-pusher comprising a plate fastened to the carrier to travel with it and cleat push-bars supported on said plate and laterally adjustable thereon to coincide with said guides, substantially as described.

2. In a feed device for box-blank material, the combination with a frame and an endless carrier thereon, of outer and intermediate cleat-guides supported on the frame and relatively adjustable thereon, said outer guides having bed-[fols. 1503 & 1504] rails yieldingly supported to extend along their inner sides, and a cleat-pusher comprising a plate fastened to the carrier to travel with it and cleat push-bars supported on said plate and laterally adjustable thereon to coincide with said guides, substantially as described.

3. In a feed device for box-blank material, the combination with a frame and an endless carrier thereon, of outer and intermediate cleat-guides supported on the frame and relatively adjustable thereon, said outer guides having bed-rails yieldingly supported to extend along their inner sides and carrying at intervals cleat-clamping springs, and a cleat-pusher comprising a plate fastened to the carrier to travel with it and cleat push-bars supported on said plate and laterally adjustable thereon to coincide with said guides, substantially as described.

4. In a feed device for box-blank material, the combination with a frame and an endless carrier thereon, of cleat-guides supported on the frame and relatively adjustable thereon, a cleat-pusher comprising a plate fastened to the carrier to travel with it and cleat push-bars supported on said plate and laterally adjustable thereon to coincide with cleats on said guides, and a presser-bar device supported to bear downward against sheet material imposed on said cleats, substantially as described.

5. In a feed device for box-blank material, the combination with a frame and an endless carrier thereon, of a cleat-guide supported on the frame, and a cleat-pusher comprising a plate fastened to the carrier to travel with it, a push-bar extending across the base of said plate and having a head at one end provided with a groove in which the plate is confined at its forward edge, and a bearing secured to the opposite end of said push-bar and containing a groove

in which said plate is confined at its opposite edge, substantially as described.

6. In a feed device for box-blank material, the combination with a frame and an endless carrier thereon, of cleat-guides supported on the frame, and a cleat-pusher comprising a plate fastened to the carrier to travel with it and having beveled forward and rear edges, push-bars extending at intervals across the base of said plate and having heads at their forward ends containing grooves confining the plate at its forward edge, and bearings secured to the rear ends of said push-bars and containing grooves confining said plate at its rear edge, substantially as described.

7. In a feed device for box-blank material, the combination with a frame and an endless carrier thereon, of outer and intermediate cleat-guides supported on the frame, said outer guides having bed-rails yieldingly supported to extend along their inner sides, a cleat-pusher comprising a plate fastened to the carrier to travel with it, cleat push-bars extending at intervals across the base of said plate and having heads at their forward ends containing grooves confining the plate at its forward edge, and bearings secured to the rear ends of said push-bars and containing grooves confining said plate at its rear edge, and presser-bar devices supported to bear downward against sheet material imposed on said cleats, substantially as described.

Frederick P. Rosback.

In presence of M. J. Frost, R. T. Spencer.

(Here follows side folios 1505-1516.)

1505-1506

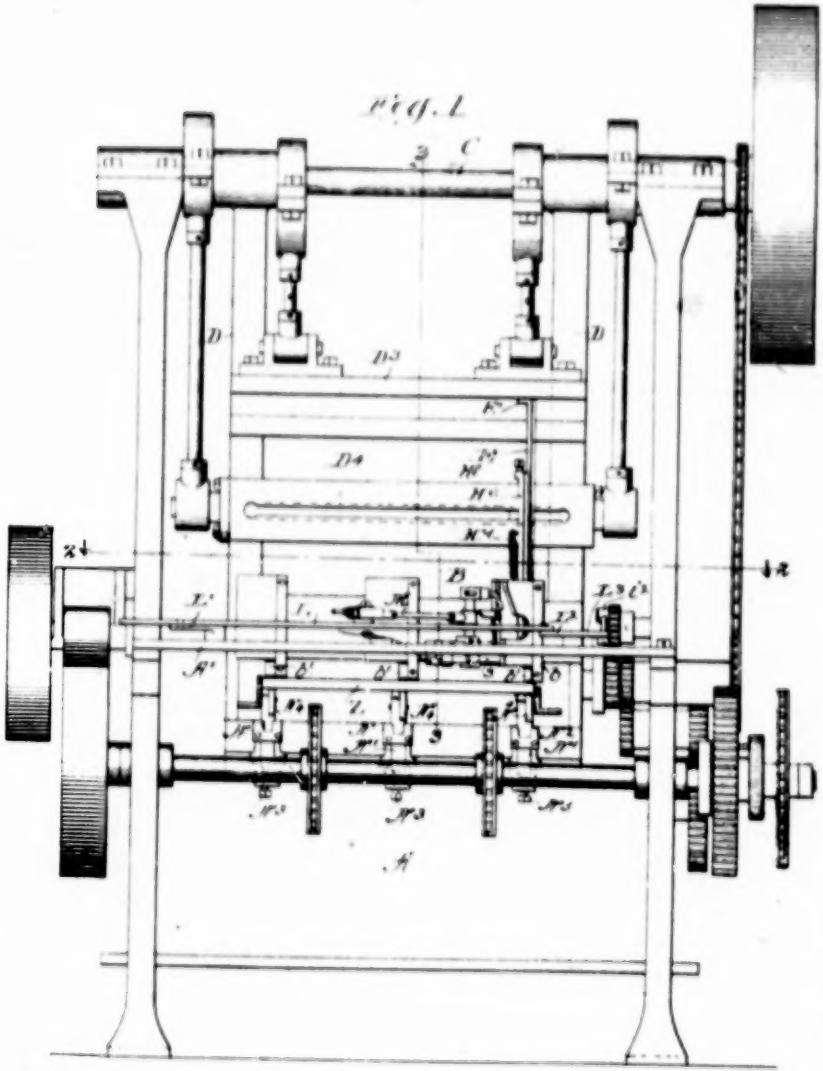
No. 630,303. Patented Aug. 1, 1899.

F. P. ROSBACK.

STAPLE FORMING AND DRIVING MACHINE.

(No Model.) Application filed Mar. 17, 1899. 6 Sheets—Sheet 1.

Fig. 1.



Witnesses
[illegible]
Wm. M. Rheem

Inventor
Frederick P. Rosback.
By Dyrenforth & Dyrenforth
Attys.

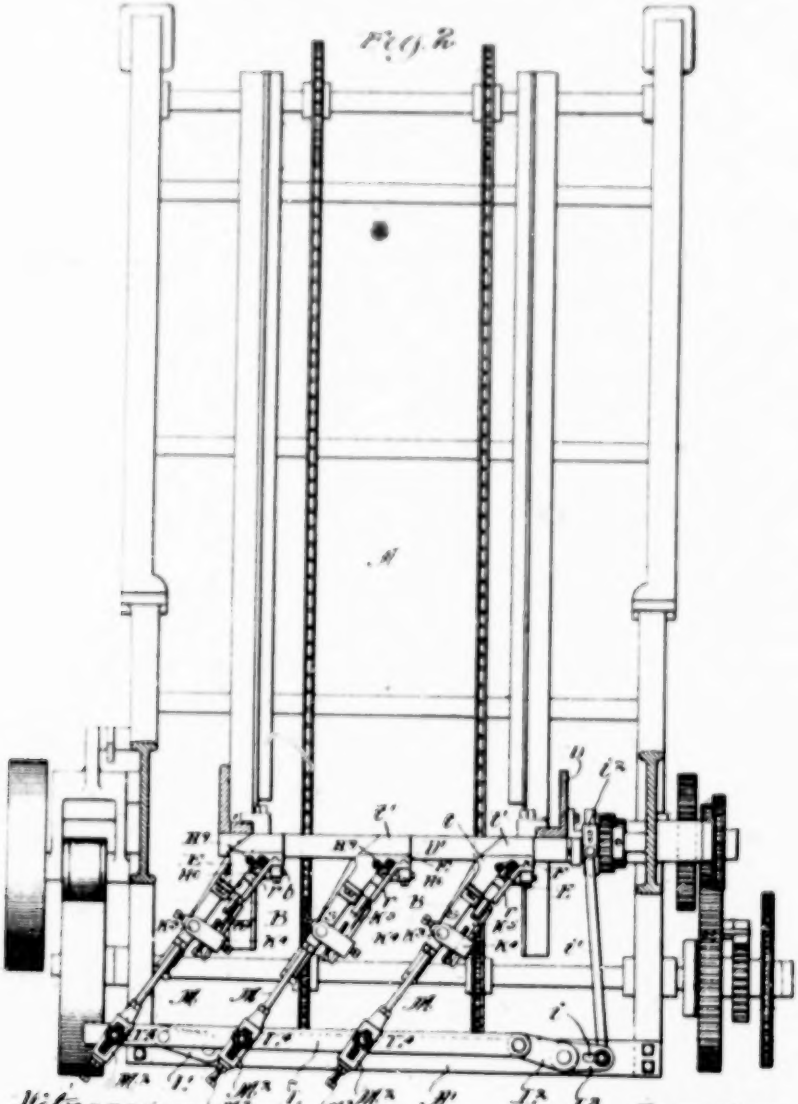
No. 630,303. Patented Aug. 1, 1899.

F. P. ROSBACK.

STAPLE FORMING AND DRIVING MACHINE.

(No Model.) (Application filed Mar. 17, 1899.) 6 Sheets—Sheet 2.

Fig. 2.



Witnesses:
Wm. Wallace
Wm. W. Thomas

Inventor:
Frederick P. Rosback.
By Dyrenforth & Dyrenforth,
Attys.

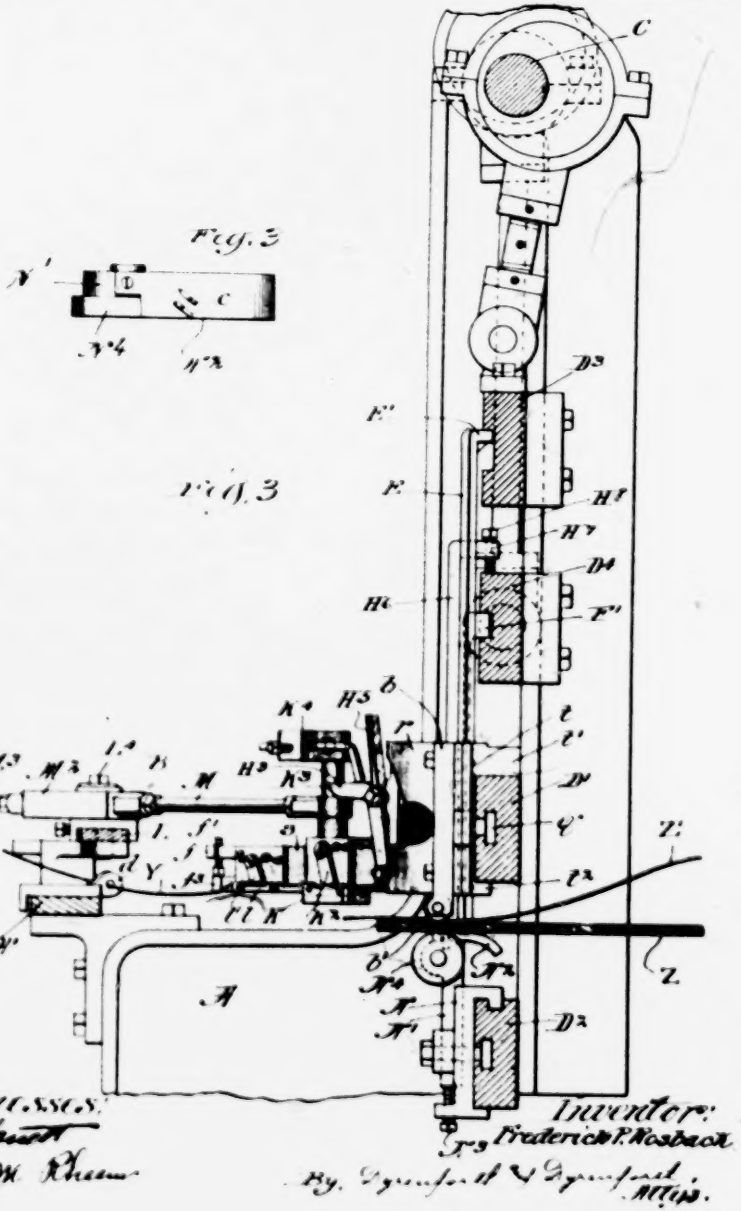
1509-1510

No. 630,303. Patented Aug. 1, 1899.

F. P. ROSBACK.

STAPLE FORMING AND DRIVING MACHINE.

No Model.) Application filed Mar 17, 1899 6 Sheets—Sheet 3.



No. 630,303. Patented Aug. 1, 1899.

F. P. ROSBACK.

STAPLE FORMING AND DRIVING MACHINE.

(No Model.) (Application filed Mar. 17, 1899.) 6 Sheets—Sheet 4.

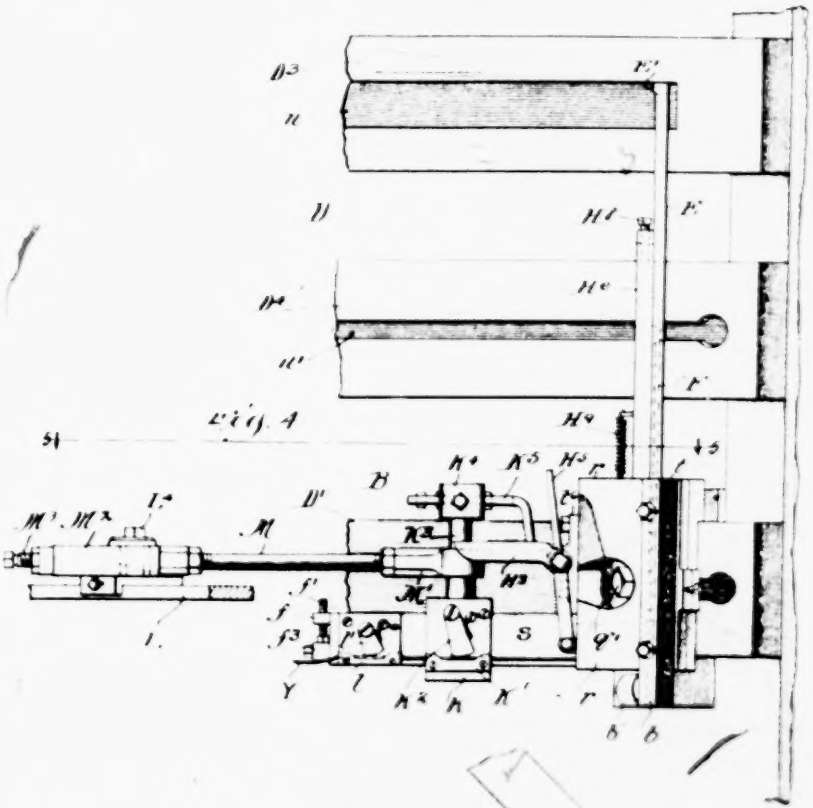


Fig. 4

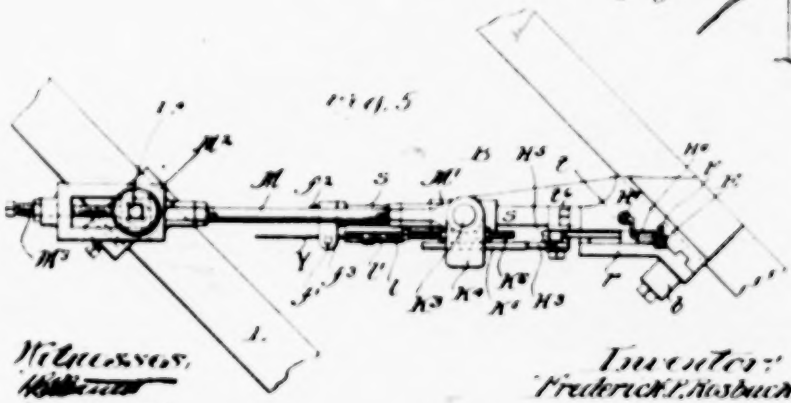


Fig. 5

Witnesses:

Jno. M. Rheem

Inventor:

Frederick P. Rosback,

By Dyrenforth & Co., Att'ys.

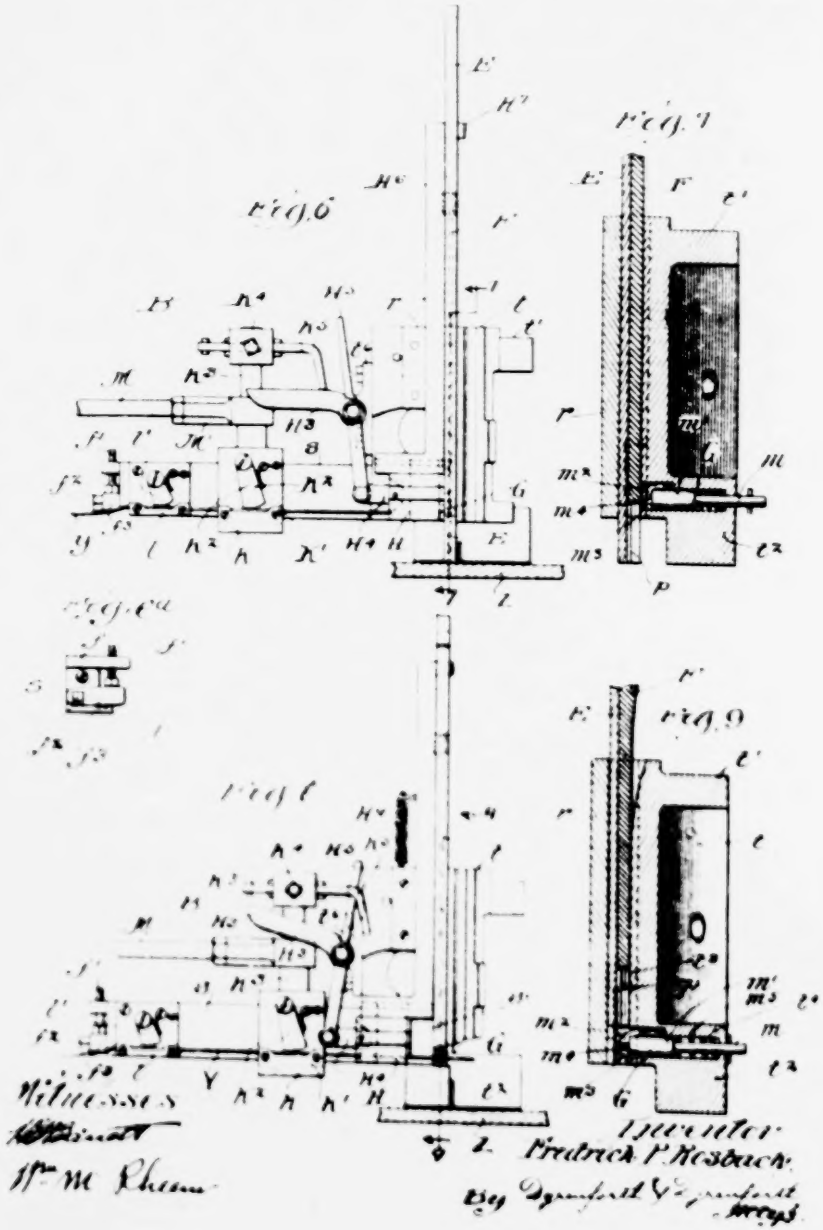
No. 630,303. Patented Aug. 1, 1899.

F. P. ROSBACK.

STAPLE FORMING AND DRIVING MACHINE.

(Application filed Mar. 17, 1899.)

No Model. 6 Sheets—Sheet 5.



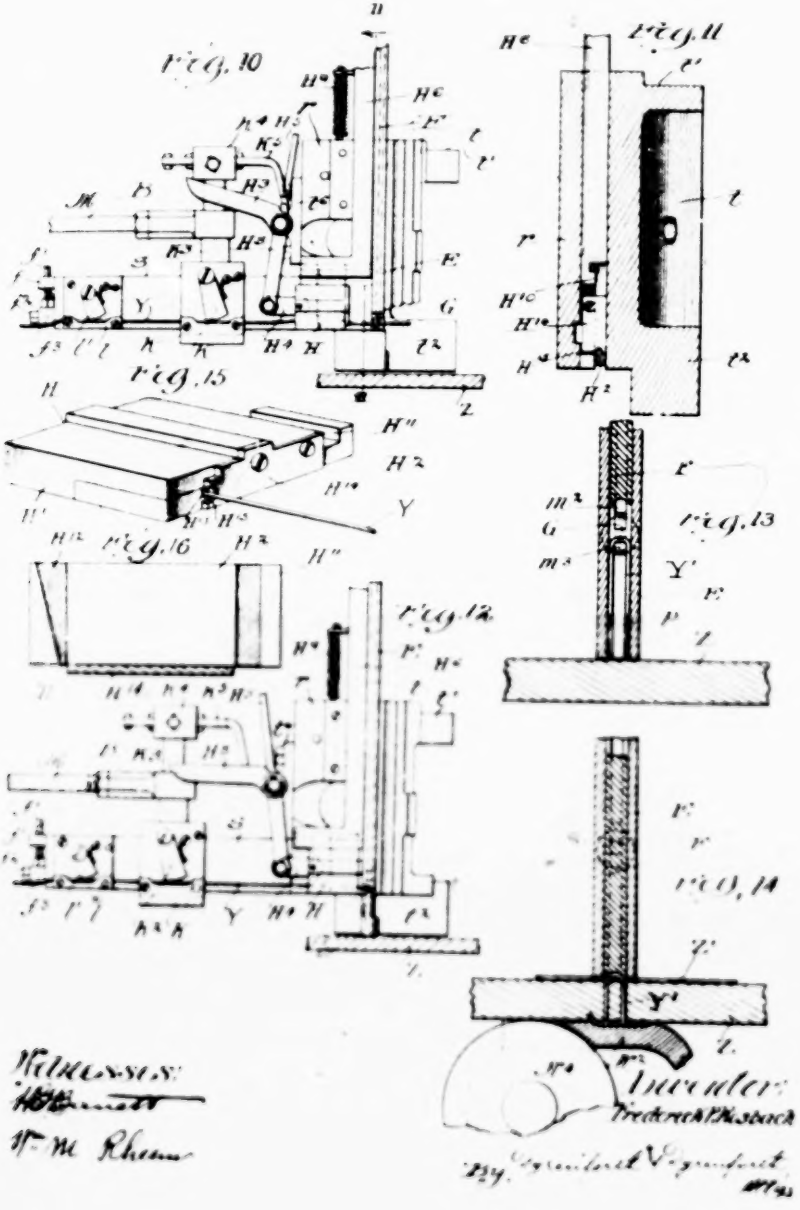
1515-1516

No. 630,303 Patented Aug. 1, 1899.

F. P. ROSBACK.

STAPLE FORMING AND DRIVING MACHINE.

(No Model.) (Application filed Mar. 17, 1899.) 6 Sheets—Sheet 6



Witnesses:

Inventor:
Frederick P. Rosback
By Crosby & Gregory
Attys.

[fol. 1517] United States Patent Office

Frederick P. Rosback, of Chicago, Illinois

Staple Forming and Driving Machine

Specification Forming Part of Letters Patent No. 630,303, Dated August 1, 1899

Application filed March 17, 1899. Serial No. 709,532. (No. model.)

To all whom it may concern:

Be it known that I, Frederick P. Rosback, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Staple Forming and Driving Devices, of which the following is a specification.

My invention relates to improvements in devices for forming and driving staples, and more especially, though not necessarily, to devices of this class employed as parts of or attachments for machines for making box-blanks.

To clearly illustrate my present invention, it is shown in connection with a box-blank making machine also of my invention and substantially of the construction illustrated in Letters Patent No. 614,348, dated November 15, 1898, and although certain of the details shown are provided to adapt my improvements to the said machine my invention in its broad sense is not to be limited to its connection with a box-blank making machine, as it may be employed alone or in various other connections for making staples or for forming and driving them.

My object is to provide a device of simple and durable construction which will make and drive a staple in each operation without danger of a miss.

In the drawings, Figure 1 is an end elevation of a machine for making box-blanks, showing for clearness of illustration only one of my improved staple forming and driving devices in place; Fig. 2, a plan section taken on line 2 2 of Fig. 1 and showing three of my improved staple forming and driving devices; Fig. 3, an enlarged and broken vertical section taken on line 3 3 of Fig. 1 and

viewed in the direction of the arrow; Fig. 3ª, a plan view of a clencher-head forming one of the details in Fig. 3; Fig. 4, an enlarged and broken perspective view showing the staple forming and driving device, its support, and the cross-heads for actuating it; Fig. 5, a broken plan section taken on line 5 5 of Fig. 4; Fig. 6, a view illustrating the first step in the operation of the device; Fig. 6ª, a detail showing the wire-straightening block; Fig. 7, an enlarged broken section taken on line 7 7 of Fig. 6; Fig. 8, a view illustrating the second step in the operation of the device; Fig. 9, a broken and enlarged section taken on line 9 9 of Fig. 8; Fig. 10, a view illustrating the third step in the operation of the device; Fig. 11, an enlarged section taken on line 11 11 of Fig. 10; Fig. 12, a view illustrating the fourth step in the operation of the device; Fig. 13, a detail section showing the same step as Fig. 12, with parts enlarged; Fig. 14, a view of the same character as Fig. 13 and illustrating the final step in the operation of the device; Fig. 15, a perspective view of a sliding wire-end guide and cutter, and Fig. 16 the cutting member of the sliding wire-end guide.

A is a box-blank making machine, and B B my improved staple forming and driving devices.

C is the drive-shaft of the machine, D a swinging frame suspended from the shaft C and having two cross-bars D' D', and D² D² cross-heads actuated from eccentrics on the shaft C to reciprocate vertically in the frame D.

Each staple forming and driving device B is formed with a block or back plate *t*, from which extends a rigid arm *s* and a removable face-plate *s*. On the rear side of the block *t* are upper and lower backward-extending lugs *t' t'*, respectively, which fit over the bar D'. In the said bar is a longitudinally extending T groove *q*, and in the back plate is a bolt opening for a bolt *q'*, having a T head to fit the groove *q*, whereby the device is fastened in proper position upon the bar D' and secured rigidly in place.

E is a staple forming bar working in a vertical groove or recess *t²* in the block *t*. In the rear side of the bar E is a longitudinally extending T groove *p*, and in the said groove is a staple discharging or driving bar F. The forming bar E is provided at its upper end with a backward extending shoulder E', extending into a recess *u* in the

cross-head D^3, and the driving-bar F is provided at its upper end with a backward-extending shoulder F', which extends into a recess n' in the cross-head D^4.

G is a yielding anvil, consisting of a stem m, a cylindrical body portion m', and upper and lower jaws m^2 m^3, with a horizontal space or recess m^4 between them. The anvil ex- [fol. 1518] tends through a socket l^4 in the block l and is pressed normally forward by a spring m^5 to extend at its jaws into the vertical groove l'. The upper jaw m^2 is cam-shaped, and the lower jaw m^3, by preference, also. In the forward side face of the arm s, adjacent to the vertical groove l', is a guide-recess s' for a horizontally-sliding wire-end guide and cutter-block H. The cutter-block consists of two relatively-movable members H' H^2. Connected with the cutter-block is a bell-crank lever H^3, the connection being through the medium of a pivotal link H^4. The bell-crank lever is pivoted to a bracket l^5 on the block l, and integral with the bell-crank lever is an upward-extending arm H^5.

H^6 is a cutter-operating bar at the side of the forming-bar E and provided at its upper end with a backward-extending shoulder H^7, extending over the top of the cross-head D^4. On the shoulder H^7 is a set-screw H^8 in the path of the upper surface of a cross-head D^4. A spring H^9, connected at opposite ends respectively with the block l and bar H^6, tends normally to draw the said bar in the downward direction. The lower end portion of the bar H^6 is provided with a lip H^{10}, (see Fig. 11,) which extends under a shoulder H^{11} of the block H^2, the connection between the two being such that the cutter-block may slide horizontally without releasing engagement with the lip H^{10}. In the face of the block or member H^2 is a horizontally-extending and gradually-reducing groove H^{12}, terminating in an opening and shearing edge H^{13}, and securely fastened to the member H' is a cutter-plate H^{14}, overlapping the member H^2 and having a recessed cutting edge H^{15}. When the member H^2 is in its normal relation to the member H', there is an opening between the cutting edges H^{13} H^{15} for the passage of a staple-wire Y.

On the arm s are a stationary wire-guide l and a pivotal spring-pawl l^2.

K is a wire-feeding block which slides upon the arm s. The block K carries a wire-guide K' and a spring pawl K^2.

L is a movable bar mounted toward opposite ends on links L' L', respectively, which are pivoted to a bar A', forming part of the main frame of the machine. The link L' is one arm of a bell-crank lever, the other arm L² of which is provided with a longitudinally extending slot s. (See Fig. 2.) The bell-crank lever is connected by means of a rod c' with an eccentric c on one of the shafts of the machine, whereby on the turning of the shaft the bar L is reciprocated laterally in the horizontal plane. The distance of movement of the bar L may be varied by the adjustment of the rod c' in the slot s, as will be readily understood. On the sliding block K is a post K', carrying a head K².

M is a connecting rod provided at one end with a head M', which pivotally engages the post K', and at its opposite end with a slotted head or yoke M², which receives a screw stud L³ on the bar L. In the end of the yoke is a tightening screw M³ to engage the stud L³. Adjustably fastened in the head K² is a finger K³ to engage the bell-crank lever H', and extending through and adjustable in the head K² is a set-screw K⁴ to engage the arm H², all as hereinafter described.

On the end of the arm e is a projecting lug f carrying a vertical set-screw f', and pivoted upon the end of e' is a swing wire-straightening block f² just in advance of the wire guide f. The block f² is adjusted by means of the set-screw f'.

Initially the parts are in the position shown in Figs. 3, 4, and 6, and the wire Y is placed in position by passing it through an eye f on the bar L, thence under the straightening block f², through the guide f under the pawl f', thence through the guide K under the pawl K', and thence through the gradually reducing groove H⁴ in the cutter block member H'. The opening at H⁴ H⁴ is close to and in line with the space *m'* between the jaws *m m* of the anvil G. In the rotation of the shafts of the box-blank making machine the bar L and connecting rod M are moved in the direction toward the right in Fig. 3 to feed the staple wire across the anvil G and causing the finger K³ to slide from the top of the bell crank lever H' and also causing the set-screw K⁴ to engaged the arm H² and move the cutter-block H to the left away from the anvil G, all as shown in

Fig. 8. As soon as the cutter block arrives at this position the cross-head D^2 engages the set-screw H^2 on the cutter-operating bar and by lifting the latter draws the sliding member H of the cutter block in the upward direction, causing the wire to be sheared off by the cutting edges H H. At this point the cross-head D^2 reaches the limit of its rise, while the cross-head D is descending. The cross-head D at the upper side of its groove *n* engages the shoulder E' of the forming bar E and presses the latter downward past the jaws of the anvil. The T-groove *p* of the forming bar causes the latter to clear the anvil, while the lower end of the bar moves from the position shown in Figs. 8, 9, and 10 to engage the staple wire at opposite sides of the anvil and form the staple Y', as shown, for example, in Fig. 13. As will be seen in that figure, the staple is formed over the jaw *m* of the anvil, the legs of the staple being in the lateral slots of the T-groove *p* of the forming bar. While a staple is being formed as described the cross-head D^2 commences its downward movement. The block K continues its movement toward the right to feed the staple wire toward the anvil, and the cross-head D^2 presses down the driving bar F. The lower end of the driving bar F engages the cam surface of the jaw *m* of the anvil and presses the latter out of its path against the resistance of the spring *m'* and engages the top of the staple and drives it downward out of the forming bar, as illustrated in Fig. 14. The cross-head D rises while [fol. 1429] the staple is being discharged, and at the completion of the discharge the lower edge of its groove *n* engages the shoulder on the forming bar E and raises the latter upward past the anvil. The cross-head D^2 also commences to rise at about the same time that the forming bar commences its upward movement, so that both the driving bar and forming bar are raised above the anvil and the latter is released and springs forward just before the end of the wire for the next staple reaches the recess t^2 of the block *t*. The engagement of the finger K^3 with the arm of the bell-crank lever H^3 moves the block H very quickly along the staple wire to the end portion of the latter and close to the anvil, whereby the cutter block operates to guide the end of the wire through the anvil-opening m^4.

The cutter-block remains in this position until in the final movement of the block K the screw K⁵ contacts with the arm H⁵ and moves the cutter-block quickly along the wire to its cutting position, at which position it remains momentarily stationary during the change in direction of movement of the bar L and attendant parts, and at this moment the cross head D⁵ reaches the limit of its rise to raise the cutter bar and starts to descend to release the cutter-bar. In the backward movement of the block K the wire is held against retraction by the pawl *l'*, the pawl K⁴ sliding freely over the wire, while in the movement of the block K in the direction to the right the pawl K⁴ grips the wire to feed it, the wire moving readily under the pawl *l'*. The length of one staple-leg may be changed by changing the adjustment of the connecting rod *c'* in the slot *c* to increase or diminish the throw of the bar L, and the position of the cutter-block H at the time the cutting of the wire is effected may be changed by adjusting the set-screw K⁵. Thus the end of the set-screw may be caused to engage the arm H⁵ and move the cutter-block to a position where the length of the staple-legs will be the same when the cutting is effected.

In the operation of the box-blank making machine a blank Z and strengthening wires Z' are fed across the lower ends of the staple forming and driving devices, the staples being driven into the blank to straddle the strengthening wires and preferably clenched. Adjustably fastened upon the bar D⁵ beneath each staple forming and driving device is a block N, to which is secured a post N', provided at its top with a clencher plate N² of the form shown in Figs. 3 and 3ª. The post N' may be raised and lowered to position it upon the block N by means of an adjusting-screw N³. As the staples are driven their ends strike grooves *c²* in the clencher plate and are upset to clench the staples. Fastened against the face plate *c* is a bar *b*, provided at its lower end with a presser-roller *b'*, and on the upper end of the bar N' is a presser-roller N⁴. After a staple has been driven and the blank material is fed along the staple passes between the rollers *b'* N⁴ and the clenched ends are pressed into the under surface of the blank.

My improved staple forming and driving device, while particularly desirable for use in connection with a box-

blank making machine such as described, is a complete device in itself and may be employed alone or in any other connection where operating mechanism is suitably adapted.

In the construction described the cutter-block H, it will be understood, performs two functions—namely, those of a wire-end guide for directing the wire to the anvil and of a wire-cutter. It moves to its wire-end-guiding position to insure the proper positioning of the wire at the anvil and then moves out of the way, so as not to obstruct the wire in the bending operation. While the wire-end guide and cutter in the present construction are one piece of mechanism, I do not wish to be limited thereto, as I believe it to be novel to provide a movable wire-end guide operating as set forth.

While I prefer to construct my improvements as shown and described, they may be variously modified in the matter of details of construction without departing from the spirit of my invention as defined by the claims.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a staple forming device, the combination with the staple forming anvil and the wire feeder, cutter, staple forming and discharging mechanisms and their actuating means, of a wire-end guide movable to one position to guide the wire to the anvil and movable from said position to be out of the way in the staple bending operation, substantially as described.

2. In a staple forming device, the combination with the staple forming anvil and the wire feeder, staple forming and discharging mechanisms and their actuating means, of a sliding wire-end guide and cutter movable toward the anvil to guide the wire, and movable away from the anvil to its cutting position, and means for operating the cutter, substantially as described.

3. In a staple forming device, the combination with the staple forming anvil, cutter, staple forming and discharging mechanisms and their actuating means, of a reciprocating wire feeder and a wire-end guide actuated by movement of the wire feeder to move to one position to guide the wire to the anvil and to move from said position to be out

of the way in the staple bending operation, substantially as described.

4. In a staple forming device, the combination with the staple forming anvil, staple forming and discharging mechanisms and their actuating means, of a reciprocating wire feeder, a wire end guide and cutter actuated by movement of the wire feeder to move toward the anvil to guide the wire and to move away from the anvil to the cutting position, [illegible] and means for operating the cutter, substantially as described.

5. In a staple forming device, the combination with the staple forming anvil and the staple forming and discharging mechanisms and their actuating means, of a reciprocating wire feeder, a sliding wire end guide and cutter between the wire feeder and anvil, actuated by movement of the wire feeder to move toward the anvil to guide the wire and to move away from the anvil to the cutting position, and means for operating the cutter, substantially as described.

6. In a staple forming device, the combination with the staple forming anvil and the staple forming and discharging mechanisms and their actuating means, of a reciprocating wire feeder, a sliding wire end guide and cutter between the wire feeder and anvil, an operating lever for said guide and cutter in the path of the said wire feeder and actuated thereby to move toward the anvil to guide the wire and then move away from the anvil to the cutting position, and means for operating the cutter, substantially as described.

7. The combination with the cross heads and their operating means, of a staple forming and driving device having a staple forming anvil, staple forming and driving mechanisms operatively connected with said cross heads, a reciprocating wire feeder, a sliding wire end guide and cutter thereon operatively connected with one said cross head, the wire end guide being actuated by the wire feeder to move toward the anvil to guide the wire and to then move away from the anvil to the cutting position, substantially as described.

8. The combination with the main frame and drive shaft, of the operating bar I, operatively geared to the drive shaft

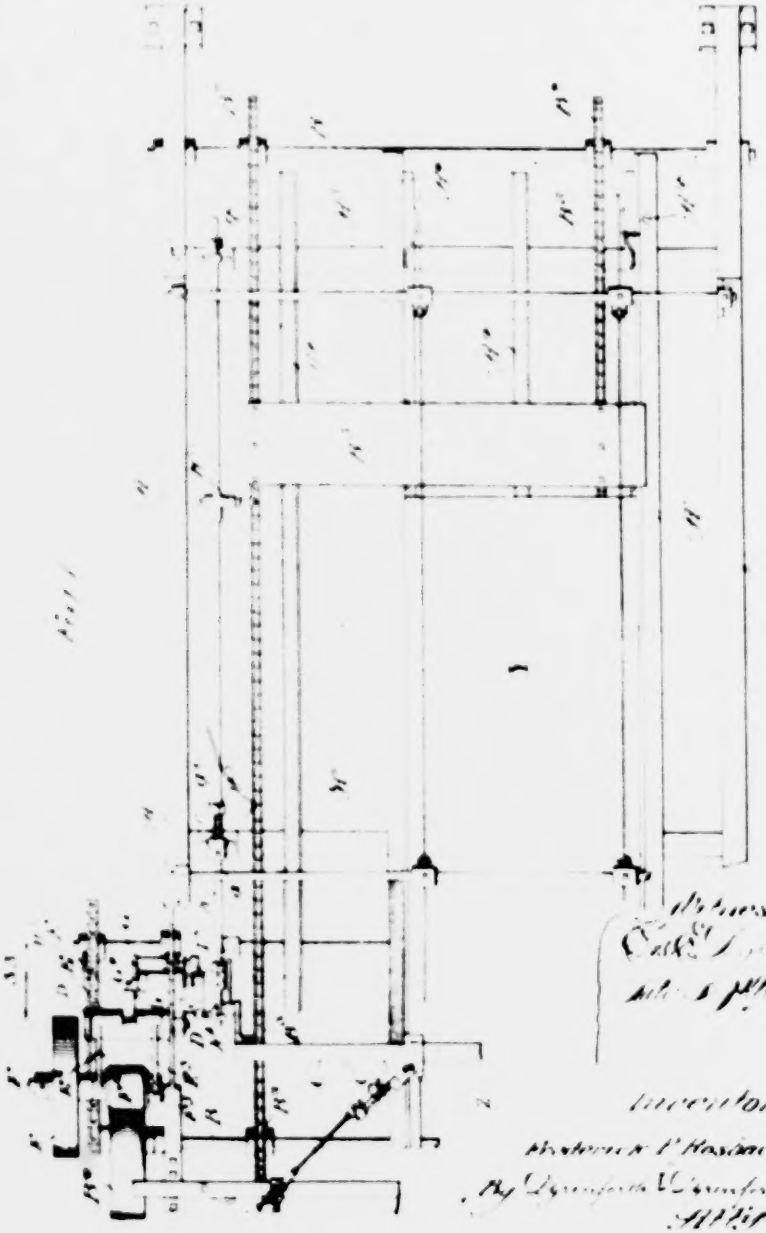
No. 636,068 Patented Oct. 31, 1899.

F. P. ROSBACK

PREVENTING FEED MECHANISM FOR BOX BLANK MATERIAL

Application filed Apr. 25, 1899.

No. Model. 3 Sheets—Sheet 1.



Witnesses
Edwin L. Wood
Albert G. Davis

Inventor:
Frederick P. Rosback.
By Crosby & Crosby
Attys.

No. 636,068 Patented Oct. 31, 1899.

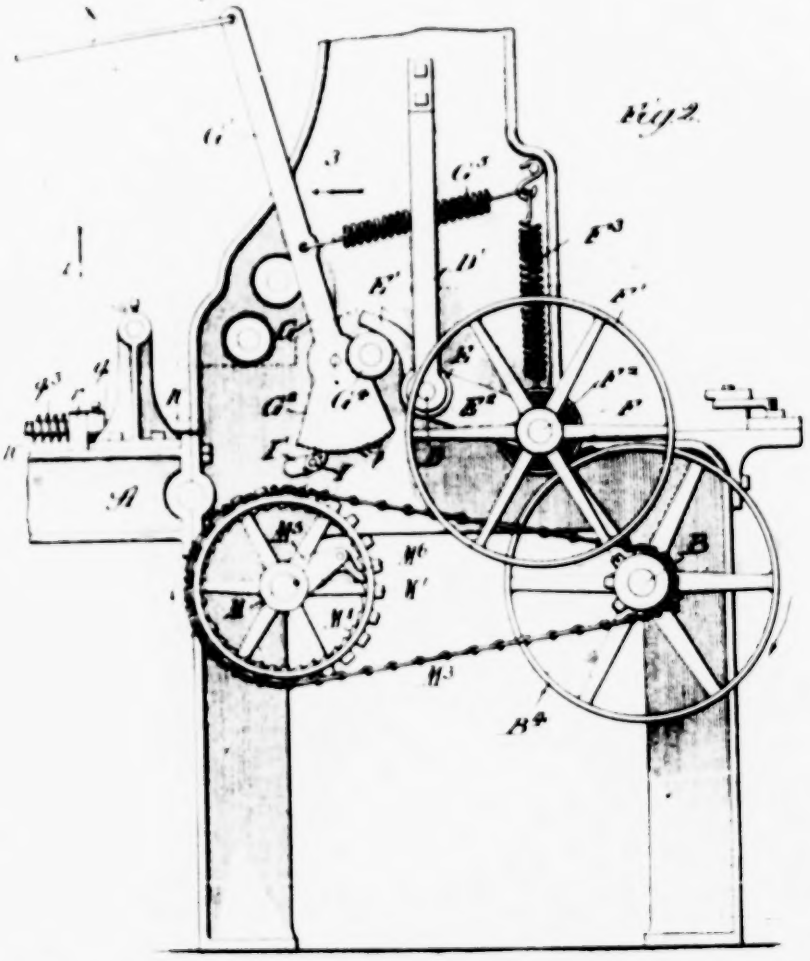
F. P. ROSBACK.

PRELIMINARY FEED MECHANISM FOR BOX BLANK MATERIAL.

Application filed Apr. 24, 1899.

No Model. 3 Sheets—Sheet 2.

Fig 2.



Witnesses:
Fred'k E. Sayles.
Edith L. Pitts.

Inventor:
Frederick P. Rosback.
By Dyrenforth & Dyrenforth,
Attys.

No. 636,068 Patented Oct. 31, 1899.

1525-1526

F. P. ROSBACK.

PREVENTIVE FEED MECHANISM FOR BOX BLANK MATERIAL.

(No Model.) 3 Sheets—Sheet 3.

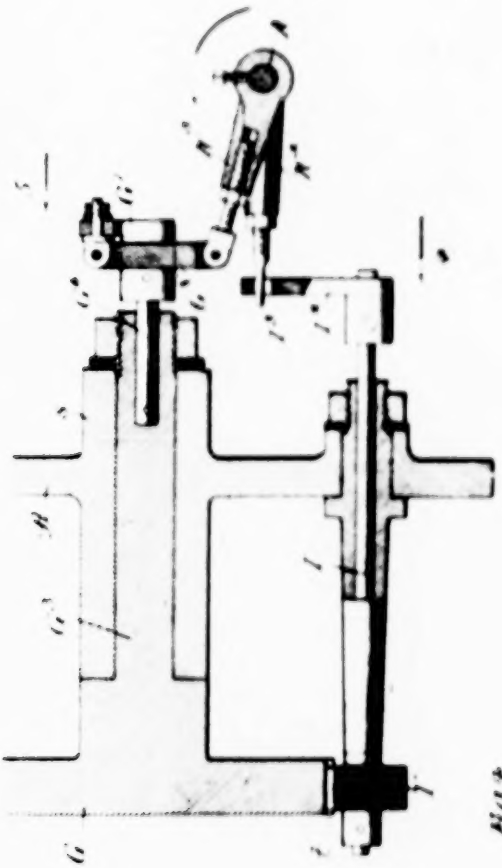


Fig. 3.

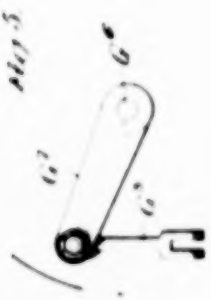


Fig. 5.

Fig. 4.

Witnesses:
Earl C. Sanford
Wm. B. Potts

Inventor:
Frederick P. Rosback.
By Dyrenforth & Dyrenforth.
Attys.

to be oscillated thereby, and a plurality of staple forming and driving devices provided with wire-feeders connected with said bar to be actuated thereby in unison, substantially as described.

2. The combination with the main frame and drive-shaft, of the operating-bar I, operatively geared to the drive-shaft to be oscillated thereby and adjustable to vary its throw, and a plurality of staple forming and driving devices provided with wire-feeders connected with said bar to be actuated thereby in unison, substantially as described.

Frederick P. Rosback.

In presence of M. S. Mackenzie, R. F. Spencer.

(Here follow sole folios 1621 1626.)

(No. 1627.) United States Patent Office.

Frederick P. Rosback, of Chicago, Illinois, Assignor to William P. Healy, of Same Place.

Preliminary Feed Mechanism for Box-Blank Material.

Specification forming Part of Letters Patent No. 636,068, dated October 31, 1899.

Application filed April 24, 1899. Serial No. 714,244. (No model.)

To all whom it may concern:

Be it known that I, Frederick P. Rosback, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Preliminary Feed Mechanism for Box-Blank Material, of which the following is a specification.

My invention relates to improvements in machines for making blanks for what are known as "wire-bound" boxes, the machine being of the class forming the subject of Letters Patent of the United States No. 614,348, granted to me November 15, 1898, and it relates more especially to

improvements in what was described in said patent as the "preliminary feed mechanism."

In the operation of the machine blank material consisting of wooden cleats of the desired length with strips or sheets of wood or veneer loosely imposed thereon is placed, by hand or otherwise, in guides in the machine and then advanced by the said preliminary feed mechanism to its initial position at the tacking devices, (which may be staple forming and driving devices,) which stitch or fasten the parts of the blank material together.

The main feed mechanism, which operates in correlation with the tacking devices to advance the blank material through the machine while the stitching is being performed, is actuated from the main drive-shaft of the machine, while the preliminary feed mechanism is actuated from another drive-pulley merely to engage and move the blank material initially to position it with relation to the tacking devices or stitchers, so that the first staples or nails will be driven at the proper distance from the end of the blank. The preliminary feed mechanism is then disengaged or thrown out of operation and the further advance of the blank material takes place under the action of the main feed.

As my present invention deals only with the preliminary feed mechanism, only so much of the entire machine is shown in the drawings as is thought necessary to clearly illustrate the construction and operation of those parts which constitute my present invention.

Referring to the drawings, Figure 1 is a broken plan section taken on line 1 of Fig. 2 and showing but one staple forming and driving device or stitcher, although two or more of the same may be employed; Fig. 2, an enlarged broken side elevation of one end portion of the machine; Fig. 3, an enlarged section taken, for purposes of illustration, on the lines 3 3 of Fig. 1, corresponding with the irregular line 3 in Fig. 2; and Figs. 4 and 5, detail views taken upon the dotted lines 4 and 5, respectively, in Fig. 3.

A A′ are the sides or cheeks of the machine, connected by cross-bars A^2, A^3, carrying the longitudinally-extending sheet and cleat guides A^4.

B and B′ are horizontal shafts at the front and rear ends of the machine, carrying sprocket-wheels B^2 and feed chains B^3. The chains B^3 carry a feed-plate B^5 and pushers, the

construction being like that shown and described in application Serial No. 704,478, filed by me February 4, 1899, for a "Feed device for box-blank material."

C is a swinging frame, and C′ a staple forming and driving device or stitcher. The parts C and C′ are fully shown and described in my aforesaid Letters Patent, and it will suffice, in the present connection, to state that they are shown in the position at which staples are driven.

D is a stub shaft or pin fastened at one end in the side cheek A and supported at its outer end by a bracket D′. Journaled on the pin D is a sleeve E, provided at its center with a cam-faced arm E′, extending in one direction, and provided at opposite ends with arms E^2 E^3, which at their free ends form bearings for a shaft F. The shaft F carries the preliminary feed driving-pulley F′ and a friction-drum F^2, the pulley being belted to a line-shaft or other driving power to rotate constantly with the shaft F and drum F^2. On the shaft B is a friction-pulley B^1 to be engaged and rotated by the friction-drum F^2; but the latter is held normally out of said engagement by a spring F^3, which tends normally to raise the shaft F and attendant parts.

G is a lever having a long arm G′ and a short arm G^2, the latter being formed with a segmental rack *t*. The lever G carries a fulcrum-shaft G^3, passing through and journaled in a bearing *s* in the cheek A. On the lever, in the [fol. 1528] position shown, is an antifriction-wheel G^4, which engages the cam-face of the arm E′. A spring G^5 tends normally to draw the lever G in the direction of releasing the arm E′, so that the drum F^2 will disengage the friction-pulley B^1 under the lifting effort of the spring F^3.

Extending through the cheek A and journaled in a bearing therein is a rock-shaft I, carrying at its outer end a pawl I′ to engage the rack *t* and carrying at its inner end a crank-arm I^2, having an elongated slot I^3.

K is a rod passing loosely through bearings *r r′* on the cross-bars A^2 A^3, respectively. On the rod K are collars *q q′*, and surrounding the rod and confined between the collar q^2 thereon and the bearing *r* is a spring q^3. The spring q^3 tends to press the rod in the direction to the right in Fig. 1, whereby the collar *q* bears against the bearing *r*, while the collar *q′*, by engaging the bearing *r′*,

limits movement of the rod in the direction to the left in Fig. 1. On the rod K, between its ends, is an adjustable stop or shoulder piece K′, which may be slid along the rod and fastened in any adjusted position. Toward the end of the rod and fastened thereto is a laterally extending arm or finger K^2, which at its free end extends into the slot l of the arm I.

On the shaft G, which carries the lever G, is a shaft-extension G^2, forming, to all intents and purposes, an integral part of the shaft G. Fastened upon the extension G^2 is a crank-arm G^3. On the shaft K is a crank-arm K, pivotally connected, by means of a link G^5, with the end of the crank G^3. A cord X, fastened to the free end of the lever G, extends to the front of the machine, where the operator stands.

The blank material Y is inserted from the front end of the machine at B′ into the guides A^4 while the machine is at rest or, at any rate, while the preliminary feed mechanism is out of operation, and the object of the preliminary feed mechanism is to move the drive chains or belts B, so that the bar or pusher B^3, which travels an endless course, will engage the rear ends of the blank material and push the latter forward, so that the forward edge thereof will come to the dotted line z in Fig. 1. The length of the blank material being determined the finger or shoulder piece K′ is adjusted along the rod K so that it will extend into the path of the pusher-bar B^3 and be engaged thereby as the forward end of the blank material approaches the dotted line z. To start the preliminary feed, the operator, after having inserted the blank material, draws upon the cord X to swing the lever G to the position shown in Fig. 2, whereby its wheel G^4 presses the cam-arm E^2 upward to force the friction-drum F^2 against the friction-pulley B^4. The parts are held in this position by the engagement of the pawl I′ with the rack l. When the parts are thus engaged, the constantly-rotating belt-pulley F^4, through the medium of the friction-wheels F^2 B^4, rotates the shaft B and moves the feed-belts B^2 until the pusher B^3, operating as a stop on the feed-belt, engages the shoulder-pieces K′ on the rod K. When the stop or pusher B^3 strikes the shoulder-piece K′, it causes the rod K to be pushed against the resistance of the spring q^3, so that its arm or fingers K^2 turns the crank I^2 and shaft I to disengage the pawl I′ from the rack l and

release the lever G. When the lever is thus released, it is swung to the right in Fig. 2 by the spring G^2 to lower the wheel G^1 along the cam-arm E', permitting the spring F^3 to raise the shaft I, pulley F'', and drum F^2 to release the engagement of the latter with the friction-pulley B^1. This disengagement causes the shaft B and feed-belts to stop just as the blank reaches the dotted line z. The machine may then be started in a manner described in my aforesaid Letters Patent, and the first staples or other fasteners will be driven at the right distance from the forward edge of the blank.

The turning of the lever G under the action of the spring G^2 turns the crank G^3 so that it swings downward and through the medium of the link G^4 swings down the crank-arm K^2 to turn the rod K on its axis and lift the end of the shoulder-piece K' out of the path of the stop or pusher B^5. When the operator pulls the cord X to start the preliminary feed, the shoulder-piece K', through the same connections, is lowered into the path of the stop B^5.

When the machine is started to drive the fasteners, the blank is fed forward by the regular main feed mechanism—that is to say, by the rotation of a shaft M, carrying a sprocket-wheel M', which is geared by a chain M^3 to a sprocket-pinion on the shaft B. The sprocket-wheel M' is loose upon the shaft M and has inner circumferential ratchet-teeth M^4. Keyed to the shaft M is an arm M^5, carrying a spring-pawl M^6, engaging the ratchet-teeth. This construction causes rotation of the shaft M to drive the shaft B; but when the latter is driven by the preliminary feed mechanism the ratchet slides over the pawl without affecting the shaft M.

While I prefer to construct my improvements as shown and described, they may be variously modified, according to requirements, without departing from the spirit of my invention as defined by the claims.

What I claim as new, and desire to secure by Letters Patent, is—

1. The combination with the feed-belt, and regular main feed mechanism therefor, of preliminary feed mechanism operating without interference from the main feed mechanism to drive the belt comprising in combination a drive-shaft, driving-gear between said shaft and the belt, a stop

projecting from and movable with the belt, and disengaging means for said gear in the path of said stop, said stop and disengaging means being relatively adjustable, substantially as and for the purpose set forth.

[fols. 1529 & 1530] 2. The combination with the feed-belt and regular main feed mechanism therefor, of preliminary feed mechanism, operating without interference from the main feed mechanism to drive the belt, comprising in combination a drive-shaft, driving-gear between said shaft and the belt, a stop projecting from and movable with the belt, and adjustable disengaging means for said gear in the path of said stop, substantially as and for the purpose set forth.

3. The combination with the feed-belt, preliminary feed drive-shaft, driving-gear between said shaft and belt, of a stop carried by the belt, gear-disengaging mechanism, a longitudinally-movable and laterally-turning shoulder-piece connected with said gear-disengaging mechanism and extending into the path of said stop to be engaged and moved thereby to operate the gear-disengaging mechanism, and means for turning the shoulder-piece out of the path of the stop in said movement, substantially as and for the purpose set forth.

4. The combination with the feed-belt, preliminary feed drive-shaft and driving-gear between said shaft and belt, of a stop carried by the belt, gear-disengaging mechanism, a longitudinally and axially movable rod connected with said gear-disengaging mechanism, and a shoulder-piece on said rod to extend into the path of said stop and operate substantially as and for the purpose set forth.

5. The combination with the feed-belt, preliminary feed drive-shaft and driving-gear between said shaft and belt, of a stop carried by the belt, gear-disengaging mechanism, a longitudinally and axially movable rod connected with said gear-disengaging mechanism, and an adjustable shoulder-piece on said rod to extend into the path of said stop and operate substantially as and for the purpose set forth.

Frederick P. Rosback.

In presence of M. J. Frost, R. T. Spencer.

(Here follow side folios 1531-1542.)

No. 652,357

Patented June 26, 1900.

J. H. GREENSTREET.

BOX MAKING MACHINE.

Application filed Apr. 24, 1899.

(No Model.)

6 Sheets—Sheet 1.

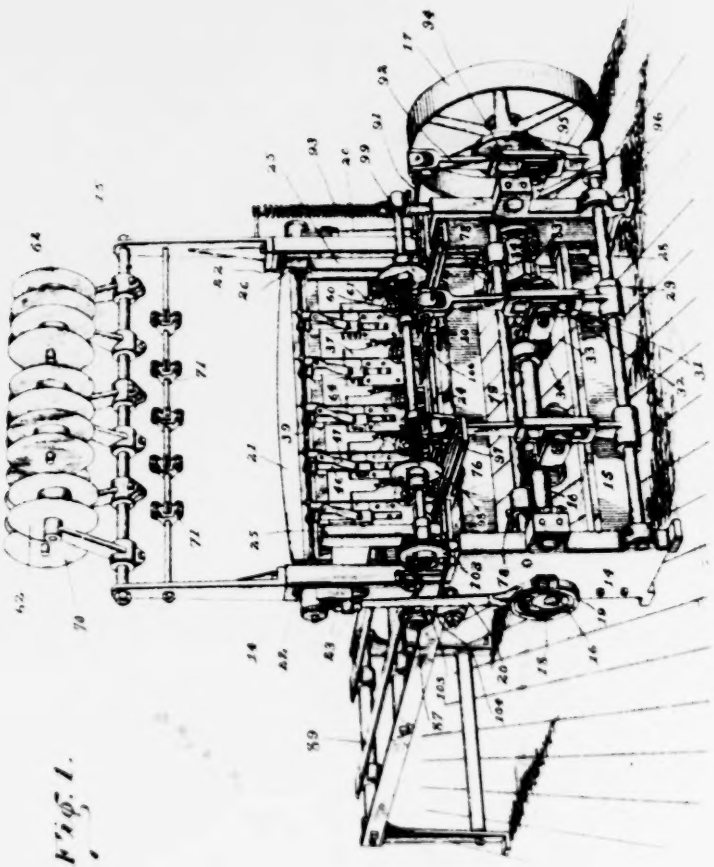


Fig. 1.

WITNESSES

E. S. Frye.

Jaurish.

INVENTOR

Jason H. Greenstreet

BY

Chester B. Bradford,

ATTORNEY

No. 652,357

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J. H. GREENSTREET.

BOX MAKING MACHINE.

(Application filed April 26, 1900.)

No Model.

6 Sheets—Sheet 2.

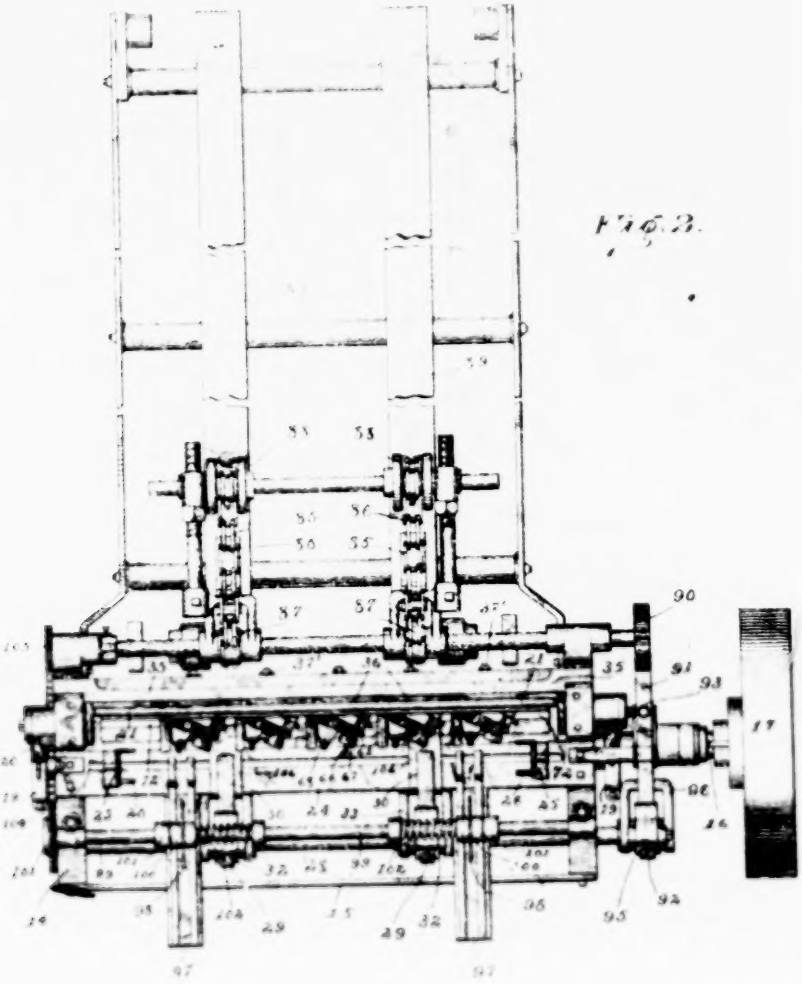


FIG. 3.

WITNESSES:

G. A. Fuge.

Jaworski.

INVENTOR

Jason H. Greenstreet,

BY

Chester & Bradford,

ATTORNEY

No. 652,357 Patented June 26, 1900.

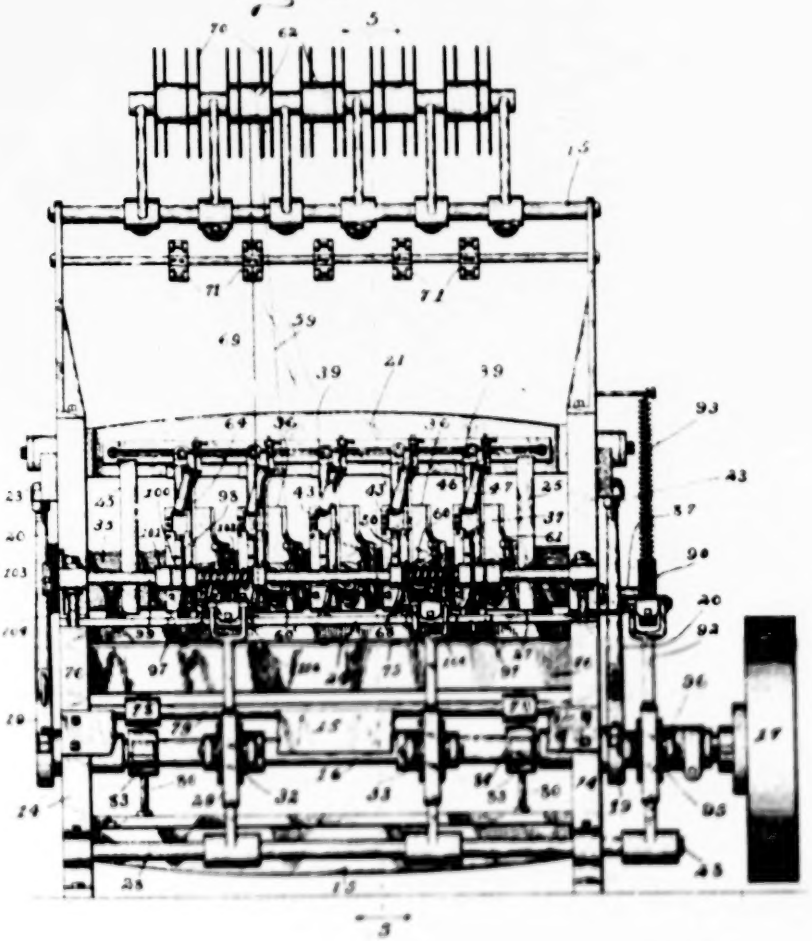
J. H. GREENSTREET.

BOX MAKING MACHINE.

(Application filed Apr. 24, 1899.)

(No Model.) 6 Sheets—Sheet 3.

Fig. 3.



WITNESSES:

C. S. Fiye.

J. A. Walsh

INVENTOR

Jason H. Greenstreet,

BY

Chester Bradford,

ATTORNEY

No. 652,357 Patented June 26, 1900.

J. H. GREENSTREET.

BOX MAKING MACHINE.

(No Model) (Application filed Apr. 24, 1899.) 6 Sheets—Sheet 4.

Fig. 4.

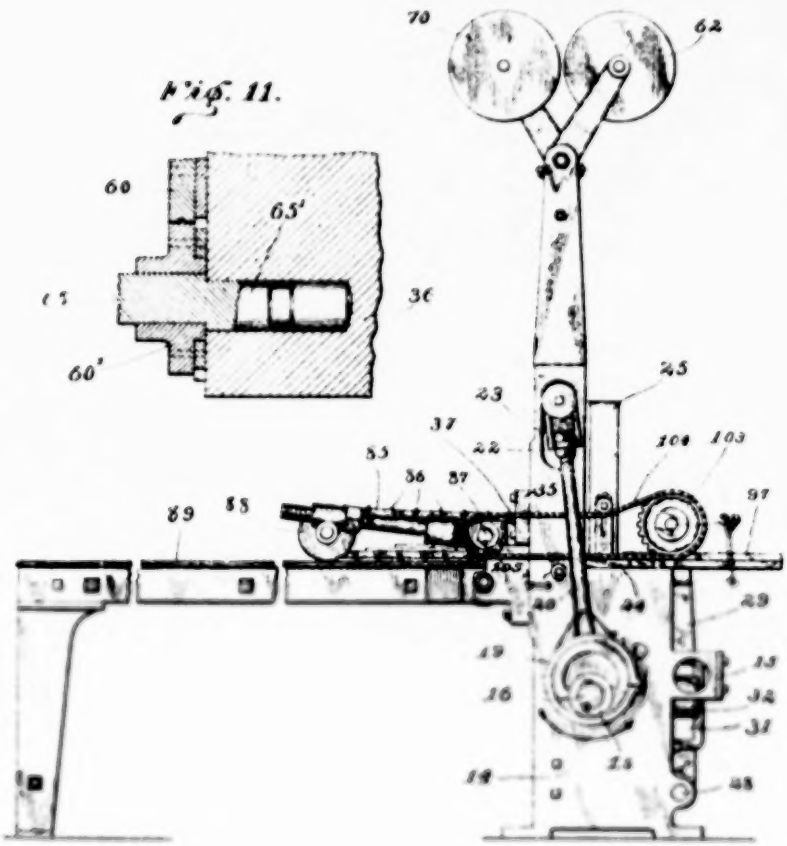


Fig. 11.

WITNESSES

C. S. Pugh.

J. A. Calvert

INVENTOR

Jason H. Greenstreet,

BY

Chester I. Bradford.

ATTORNEY

No. 652,357. Patented June 26, 1900.

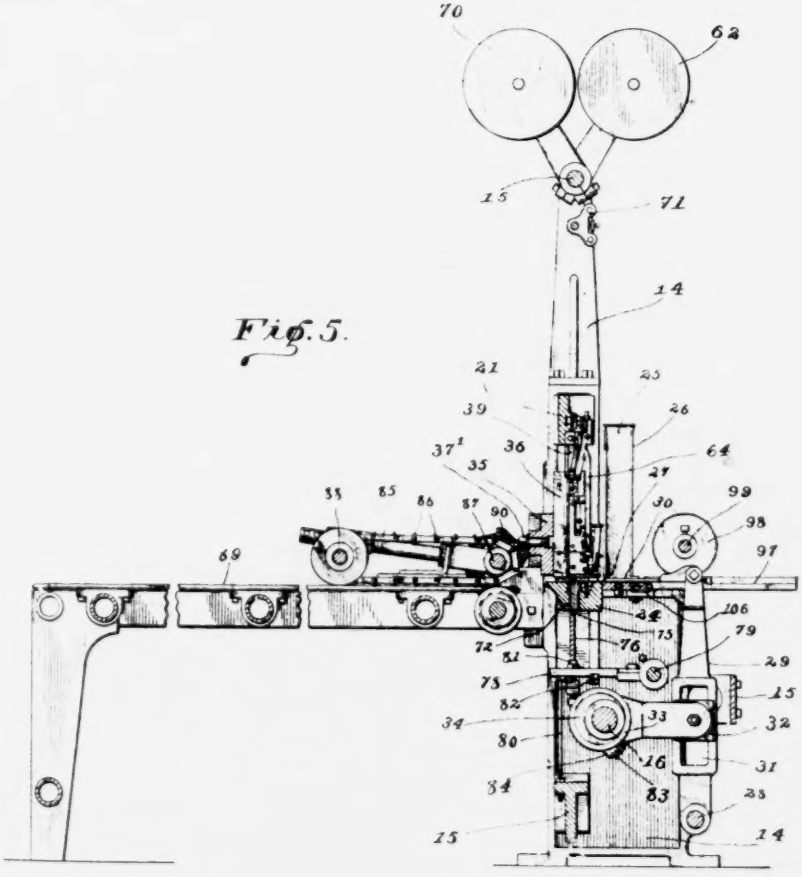
J. H. GREENSTREET.

BOX MAKING MACHINE.

(Application filed Apr. 24, 1899.)

(No Model.) 6 Sheets—Sheet 5.

Fig. 5.



WITNESSES

C. S. Frye.

J. A. Walsh

INVENTOR

Jason H. Greenstreet,

BY

Chester L. Bradford,

ATTORNEY.

No. 652,357. Patented June 26, 1900.

J. H. GREENSTREET.

BOX MAKING MACHINE.

Application filed Apr. 24, 1899.

(No Model.) 6 Sheets—Sheet 6

Fig. 6.

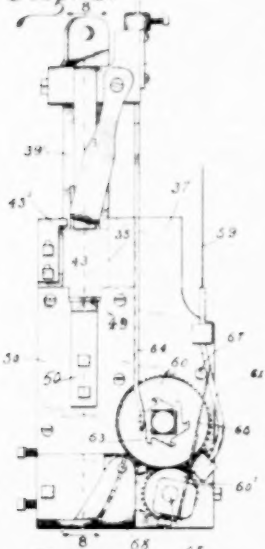


Fig. 8.

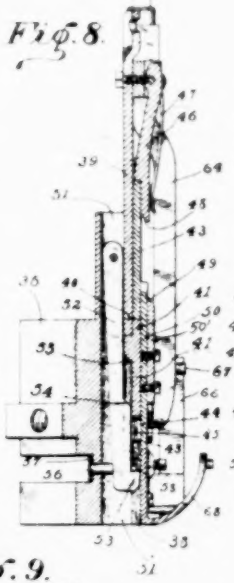


Fig. 7.

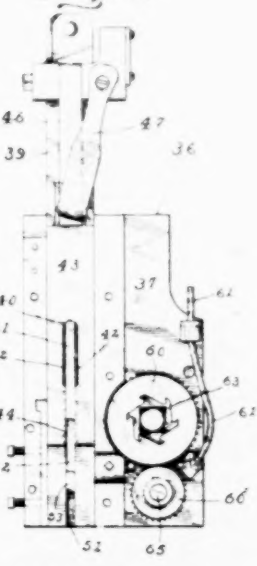


Fig. 9.

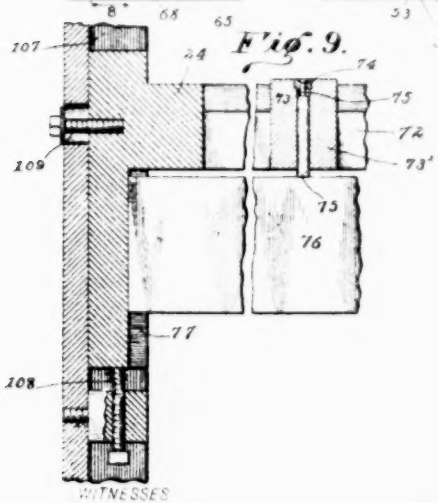
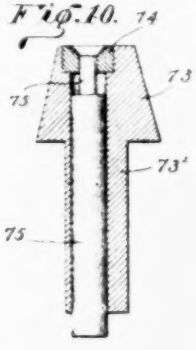


Fig. 10.



WITNESSES

C. S. Fuge.

J. A. Walsh.

INVENTOR

Jason H. Greenstreet,

BY

Chester F. Bradford

ATTORNEY

[fol. 1543] United States Patent Office

Jason H. Greenstreet, of Indianapolis, Indiana

Box-making Machine

Specification Forming Part of Letters Patent No. 652,357, Dated June 26, 1900

Application filed April 24, 1899. Serial No. 714,302. (No model.)

To all whom it may concern:

Be it known that I, Jason H. Greenstreet, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented certain new and useful Improvements in Box-Making Machines, of which the following is a specification.

My invention relates to an improvement in stapling-machines. Its object is to produce a machine capable of forming slatted box-stock, the operation of which machine shall be more efficient than that of the somewhat similar machine shown in Letters Patent No. 579,574, issued to me March 30, 1897. To this end I have provided an improved staple forming and driving mechanism, improved means for feeding the staple-wire, improved means for feeding the slats into the machine, improved means for accurately spacing the slats and for properly withdrawing the product from the machine, improved means for clenching the staples, means for feeding into the machine longitudinal or under cleats at right angles to the main slats, means for feeding said longitudinal cleats, means for varying the spaces between the main slats, and such improvements in details of construction as may be hereinafter described.

Referring to the accompanying drawings, which are made a part hereof, and on which similar reference characters indicate similar parts, Figure 1 is a perspective view of the entire machine; Fig. 2, a top or plan view, some parts of the table being broken away to enable the drawing to be made on a larger scale; Fig. 3, a front elevation; Fig. 4, a side elevation; Fig. 5, a longitudinal vertical section as seen from the dotted line 5 5 in Fig. 3; Fig. 6, an enlarged front elevation of the staple former and driver; Fig. 7, a similar view with the face-plate removed; Fig. 8, a vertical

section on the dotted line 8 8 in Fig. 6. Fig. 9 is a transverse vertical sectional detail of one of the clenching-anvils and the setting therefor; Fig. 10, a sectional detail of one of the clenching anvils and hammer, and Fig. 11 a detail of the staple-wire-feeding rolls.

In the drawings the portions marked 14 14 represent the sides of a supporting-frame, which sides are connected by appropriate cross-bars 15. Mounted in suitable bearings in the lower portions of said sides 14 14 is a transversely-arranged drive-shaft 16, provided with a pulley 17. Secured to the shaft 16, one near each end, outside of sides 14, are two eccentries 18, each surrounded by the usual strap 19, to which is attached a pitman 20. The upper ends of the pitmen 20 are secured to the projecting ends of a reciprocating head 21, which extends between the sides 14 and the ends of which project through vertical slots 22, formed through said sides. The head 21 is vertically adjustable on the pitmen by means of nuts 23.

Extending between the sides 14 and beneath the head 21 is a feed-table 24, to which is secured in front of the head 21 a pair of slat-chutes 25, said chutes being placed one at each end of the table in position to receive the ends of a series of slats piled one on top of another. The chutes 25 are adjustable toward and from each other to accommodate slats of different lengths. The forward flanges 26 of the chutes 25 are cut away at their lower ends for a distance slightly greater than the thickness of a slat, as shown at 27.

For the purpose of feeding the slats in succession to the machine I mount in the sides 14, near their lower ends, a rod 28, upon which is pivoted a pair of levers 29, to the upper end of each of which is pivoted a finger 30, the free end of which rests upon the feed-table 24, one near each slat-chute. In order that the throw of fingers 30 may be adjusted, each lever 29 is slotted at 31, and in said slot is adjustably mounted a cross-head 32. Pivoted to each cross-head 32 is the end of an eccentric strap 33, each operated by a suitable eccentric 34, secured to the drive-shaft 16.

Secured to the sides 14, between the head 21 and feed tables 24, is a bar 35, to which is secured a series of stapling-heads 36, the bar being slotted and each head being longitudinally adjustable along the bar by means of a bolt

37′, passing through the slot and into the head. Each head 36 is wedge-shaped in cross-section, so that its face 37 lies at an angle to the median line of the machine. The faces 37 of the heads 36 are each provided with a vertical channel 38, the bottom of which lies parallel with face 37 and in [fol. 1544] which is mounted a reciprocating hammer-bar 39, the upper end thereof being adjustably secured to the head 21. The bar 39 is provided at its lower end with a mortise 40, into which is removably fitted and fixed the upper end of a hammer-head 41, which is somewhat thicker than the bar 39 and projects from the face of said bar. The projecting portion of said head 41 is provided on each side with a longitudinal tongue 42. Slidably mounted upon the face of bar 39 is a follower or staple former 43, which also lies within and fits the channel 38. The former 43 is shorter than the bar 39 and is provided at its lower end with a longitudinal slot 44, adapted to receive the projecting portion of the hammer-head 41, the sides of said slot being each provided with a groove 45, adapted to receive the corresponding tongue 42. The upper end of the former 43 is normally engaged and held in its outer position on the bar 39 by a dog 46, one end of which is pivoted to said bar 39 and the free end of which is held in position by means of a spring 47. The upward return movement of the former 43 is limited by a suitable stop 43′. The free end of the dog 46 projects over the end of the former 43, and the projecting end is beveled, as at 48, so as to engage and be thrown out by the upper beveled end 49 of a face-plate 50, which is secured to the face 37 in position to retain the several parts within the channel 38. The bevel 49 is prolonged by the upper end of a piece 50′, which may be bolted or otherwise secured to the plate 50. Formed in the bottom of the channel 38 is a narrow channel 51, within which is pivoted a finger 52, the free end thereof carrying a projecting lug or swage 53, which projects into and fits a slot 44 beneath the lower end of the hammer-head 41. In order to withdraw swage 53 after the staple has been formed, the finger 52 is provided with a beveled shoulder 54, adapted to be engaged by an oppositely-beveled shoulder 55, formed upon the back of the hammer-head 41. The finger 52 is normally held out by means of a pin 56, which in turn is yielding forced inward by a flat spring 57.

Mounted in the face 37 of the head 36 and leading into the channel 38, immediately above the swage 53, is a hardened bushing 58, through which the staple-wire 59 is passed. For the purpose of feeding the wire 59 through the bushing 58 and into the staple-former, I provide a pair of feed rolls 60 and 60′, which are geared together, the operating peripheries thereof being preferably on the pitch-lines of the gears. The rolls 60 and 60′ are placed so as to direct the staple-wire into the bushing 58, and leading into the mouth of said rolls is a tubular wire-guide 61, through which the staple-wire is passed from its bobbin 62. To intermittently rotate the rolls 60 and 60′, said roll 60′ is provided with a ratchet 63, which is engaged by a finger 64, adjustably secured to the reciprocating hammer-bar 39. In order to prevent a backward movement of the roll 60 and of the staple-wire, the shaft 65 of roll 60′ is provided at its inner end with an eccentric portion 65′, which is rotatably mounted in the head 36. Shaft 65 is yieldingly held against a counter clockwise movement by means of a flat spring 66, one end of which is secured to said shaft 65, while the free end thereof engages a stop 67. The eccentric of shaft 65 is so set that when the shaft is moved against the action of the spring 66 the roll 60′ will move away from roll 60. If the shaft 65 is moved in the opposite direction, however, its movement is unimpeded, the spring on leaving the stop 67 and roll 60′ is brought closer to roll 60, thus pinching the staple-wire and preventing a backward movement of said wire or of roll 60.

Secured to the face 37 of the head 36, at its lower end, is a suitable guide-plate 68, adapted to receive and guide the slat-wire 69 beneath the lower end of channel 38. The slat-wires 69 are carried by suitable bobbins 70 and are passed through tension-yokes 71.

Immediately beneath channels 38 of the staple-former the feed-table 24 is provided with a transverse slot 72, the upper end of which is dovetailed, so as to receive the heads 73 of a series of anvils 73′, one of which is mounted beneath each staple-former. Each anvil is provided with a concave clenching-socket 74, the bottom of which is formed by a reciprocating clenching hammer 75. The lower ends of hammers 75 rest upon a reciprocating cross-bar 76, mounted in ways 77 in table 24. The cross-bar 76 is supported by a pair of arms 78 78, carried by a rock-shaft 79,

which shaft is mounted in the sides 14. Arms 78 normally rest upon the upper ends of supports 80, and suitable adjusting-screws 81 are placed between said arms and the cross-bar 76. Said arms 78 are provided on their lower faces with steel lugs 82, which are intermittently engaged by similar lugs 83, which form the working faces of cams 84, carried by the drive-shaft 16.

It is important that the finished product be accurately carried away from the staple-drivers, so that the slats will be uniformly spaced therein. For this purpose, therefore, I provide a pair of carrier-chains 85 85, the links of which are provided with sharp teeth 86, adapted to sink into the slats. Said chains 85 pass over a driving-shaft 87 and an idler 88, suitably mounted above a receiving-table 89, which extends to the rear from sides 14. In order to intermittently advance the carrier-chains 85, the shaft 87 is provided at one end with a ratchet 90, the teeth of which are engaged by the free end of a finger 91. Finger 91 is pivoted to the upper end of a lever 92, pivoted upon rod 28, and is held in engagement with ratchet 90 by means of a spring 93. The lever 92 is provided with a longitudinal slot 94, in which is adjustably mounted a cross-head 95, to which is pivoted the end of an eccentric-strap 96, said strap being operated by means of an eccentric carried by drive-shaft [fol. 1545] 16. By means of the adjustable cross-head 95 the throw of the lever 92, and the consequent movement of the carrier-chains, may be adjusted and the space between the slats varied, differently spaced ratchets being substituted for the ratchet 90.

In slatted box-stock it is often desirable to supplement the slat-wires by longitudinal cleats or runners. In order, therefore, that such cleats may be attached to the slats by the same staples with which the slat-wires are attached and at the same time, I secure to the forward end of feed-table 24 one or more cleat-guides 97, each so arranged as to direct its cleat beneath one of the staple-drivers. Above each cleat-guide, in position to engage the cleat, I mount a serrated feed-wheel 98. Each feed-wheel 98 is loosely mounted on a shaft 99 and is provided with a clutch member 100, adapted to be engaged by a similar clutch member 101, carried by the shaft. The two clutch members are normally held in engagement by means of a spring 102, and their arrangement is such as to allow such rotation of the feed-roll

as to permit the introduction of a cleat without moving the other portions of the machine. Shaft 99 is provided at one end with a sprocket-wheel 103, receiving a chain 104; which is also passed over a sprocket-wheel 105, carried by shaft 87, the cleats being thus advanced with the same speed and at the times as the receiving-chains and slats engaged thereby.

In order to allow for the thickness of the cleats, risers 106 are placed on table 24 in position to receive the slats. The anvils 73, other than those lying beneath the cleats, are then allowed to project above the feed-table 24 a distance equal to the thickness of the risers, so as to properly support the slats. In order to accommodate slats of different thicknesses, the feed-table is vertically adjustable in ways 107 of sides 14 by means of adjusting-screws 108. Clamping-bolts 109 are provided to hold the table in any adjusted position.

The operation of the machine is as follows: Each of the bobbins 62 is provided with staple-wire. Each bobbin 70 is provided with slat-wire. Longitudinal cleats are passed under rolls 98 and beneath the corresponding staple-drivers and a series of slats placed in the slat-chutes 25, the bottom slat lying on top of the cleats and also on top of the fingers 30, when the parts are in the position shown in the drawings. Each staple-wire is then threaded through its guide-tube 61, between rolls 60 and 60', through bushing 58, into and across channel 38, beneath follower 43, and on top of swage 53. Each slat-wire is then threaded through the tension-yoke 71, passed through the guides of the plate 68, and along beneath the hammer 41 of the corresponding head 36. With the several parts in these positions and in the positions shown in the drawings the machine is ready for operation, the drive-shaft to be turned in the direction indicated by the arrow. As the shaft 16 rotates the cams 34 will cause the lever 29 to withdraw the finger 30 until a slat drops in front thereof. A further rotation of the shaft throws the fingers 30 forward again and forces the slat forward beneath the staple-drivers. At the same time the movement of the strap 96 and its eccentric has caused the shaft 87, shaft 99, and feed-rolls 98 to force the cleats forward the desired distance. A continued movement of the shaft 16 causes the cams 18 to bring the head 21 down. The move-

ment of the head 21 forces the hammer-bars 39 down, said bars carrying with them for a time the followers 43. The first movement of the follower 43 brings the lower end thereof into engagement with the wire 59, and this, in coöperation with bushing 58, cuts off a length of staple-wire equal to the width of channel 38. A continued movement of the follower doubles the severed portion of staple-wire over the swage 53, the ends of said wire lying in the grooves 45. Just before the lower end of the hammer 41 reaches the swage 53 the shoulder 55 of said hammer is brought into engagement with shoulder 54 of the finger 52 and the swage is withdrawn. At practically the same time the lower end of the follower has reached the slat, the two portions thereof straddling the slat-wire 69, the beveled end 48 of the dog 46 is brought into engagement with the beveled end 49 of the face-place 50 and the dog thrown out of engagement with the follower, thus leaving the hammer-head free to advance, its lower end being in engagement with the head or doubled portion of the staple, and this forces said staple into the slat astride the slat-wire, the legs of said staple being supported during the operation by the walls of slot 44. As the ends of the staple pass through the slat they are forced toward each other by the clenching-socket 74. When the head of the staple has been pressed home by the hammer-head and before said hammer-head has left the staple, the lugs 83 and cams 84 are brought sharply into engagement with the lugs 82 of the arms 78, which arms thus force the bar 76 upward, the several clenching-hammers 75 coming sharply into engagement with the staple ends and clenching them firmly in position. While this is being done, the fingers 30 have again been caused to recede and a new slat has dropped down in front thereof. A continued rotation of the shaft causes fiingers 30 to advance another slat beneath the staple-drivers. At the same time the hammer-bars 39 are drawn upward by the upward movement of the head 21. As the bars 39 move upward the followers 43 move therewith until the upper end of each is brought into engagement with its stop 43′. The bars 39 continue their upward movement, however, until a dog 46 may be forced by springs 41 back into engagement with the upper ends of the followers. The upward movement of

[fol. 1546] the bars 39 allows each swage 53 to be moved back into normal position by means of the springs 57 and pins 56. At the same time the finger 64 has advanced the rolls 60 and 60′, the staple-wire 59 being positively fed forward thereby until its end extends across the channel 38 beneath the follower and on top of the swage When the slats come from beneath the staple-drivers, they are positively engaged by the teeth 86 of the chains 85, and as the machine continues to advance there are at all times several slats engaged by said teeth, so that said slats and the slat-wires attached thereto are positively withdrawn from the machine, insuring an accurate spacing of the slats. The operation of the staple-drivers over the longitudinal cleats is the same as the others, the staples, however, being clenched into the cleats instead of into the slats.

By means of the adjustable cross-heads in the levers 29 slats of different widths may be used by varying the throw of the fingers 30, and the spaces between the slats may be varied by substituting a different ratchet 90 and changing the throw of the lever 92 and the consequent movement of the finger 91.

The staple forming and driving mechanism lies at an angle to the direction of motion of the slats, so that the staples while straddling the slat-wires lie close to said wires and as far as possible from the edges of the slats, thus preventing as far as possible any splitting of the slats.

Having thus fully described my said invention, what I claim as new, and desire to secure by Letters Patent, is——

1. In a stapling-machine, a staple-wire feeder consisting of a pair of feed-rolls geared together, an eccentrically-mounted shaft for one of said rolls, and a spring for yieldingly holding said shaft in position, for the purpose described.

2. In a stapling-machine, a staple-wire feeder consisting of a pair of feed-rolls geared together, an eccentrically-mounted shaft for one of said rolls, a spring secured at one end to said shaft and engaging a stop, the arrangement being such that the movement of said shaft about its axis is practically unresisted in one direction and yieldingly resisted in the other direction.

3. In a stapling-machine, the combination with a feed-table and staple-driving means, of means for feeding a series of slats in succession beneath the staple-drivers, and means for feeding beneath one or more of said staple-drivers a cleat lying at an angle to the slats, consisting of a shaft, a serrated feed-wheel thereon, and a clutch whereby said wheel is driven from said shaft while being permitted practically free rotation thereon in one direction, the arrangement being such that the staples will pass through the slats and cleats.

4. In a stapling-machine for attaching one or more continuous wires to a series of slats, the combination with the feed-table, of one or more staple forming and driving means, a slat-guide leading to the feed-table, a pair of reciprocating fingers arranged to feed the slats in succession to the stapling means, means for reciprocating said fingers, one or more cleat-guides leading to the feed-table beneath one or more of the stapling means, means for feeding cleats through said guides and means for positively engaging the wired slats and withdrawing them from the stapling means so as to preserve the accurate spacing of said slats.

5. In a stapling-machine for attaching one or more continuous wires to a series of slats, the combination, with the feed-table, of one or more staple forming and driving means, a slat-guide leading to the feed-table, a pair of fingers arranged to feed the slats in succession to the stapling means, levers having an adjustable throw for reciprocating said fingers, one or more cleat-guides leading to the feed-table beneath one or more of the stapling means, a pair of chains having teeth for positively engaging the wired slats as they pass from beneath the stapling means, a lever having an adjustable throw for intermittently actuating said chains, feed-rolls for engaging the cleats, and a driving connection between said chains and the cleat-feed rolls.

6. In a stapling-machine, the combination, with the feed-table, of the staple-driving mechanism, a slat-guide leading to the table, a reciprocating feeding device arranged to engage the slats in succession and push them beneath the staple-drivers, and a separate intermittingly-operated take-away device arranged to engage said slats on the opposite

side of said table and keep the stapled product pulled away as the work proceeds, substantially as set forth.

7. In a stapling-machine, the combination, with the staple-driving means, of a clenching anvil coöperative, mounted therewith, a clenching-hammer mounted to reciprocate in a perforation in said anvil, its operating-face normally forming the bottom of a recess in said anvil, the vertically-reciprocating bar 76 mounted on movable supports which rest in their lowermost position on fixed rests, said reciprocating bar supporting in turn the lower end of said hammer, and a cam-operated device for intermittingly driving said bar and hammer carried thereby upward, substantially as set forth.

8. In a stapling-machine, the combination, of the table, the slat-guides leading thereto, the reciprocating feeders for the slats, the stapling mechanism, the means for feeding the longitudinal wires intermittingly, the longitudinal cleat-guides, and the separate feeding mechanism for the longitudinal cleats, substantially as set forth.

9. In a stapling-machine, the combination, of the frame, the reciprocating head 21, the bar 35, the stapling-heads, adjustably mounted thereon, the reciprocating hammer-bars, each mounted in a way in one of said heads and [fols. 1547 & 1548] secured at its upper end to the head 21, the movable swage, a bifurcated follower arranged to straddle said swage and reciprocate upon the projecting portion of the hammer-head, a dog pivoted on the hammer-bar and engaging the follower, a trip for throwing said dog out of engagement located to act when the follower has reached the bottom of the way, means carried by the hammer-bar for throwing back said swage at the same time, the anvil and co öperating the same, means for feeding the slats and wires to the machine, and separate means for drawing the finished work away, all substantially as set forth.

In witness whereof I have hereunto set my hand and seal, at Indianapolis, Indiana, this 21st day of April, A. D. 1899.

Jason H. Greenstreet. [L. S.]

Witness: Chester Bradford, James A. Walsh.

(Here follow side folios 1549-1554)

No. 659,772.

Patented Oct. 16, 1900.

W. S. STUCKENBERG.

BOX FORMING MACHINE.

Application filed Feb. 19, 1900.

No Model.

3 Sheets—Sheet 1.

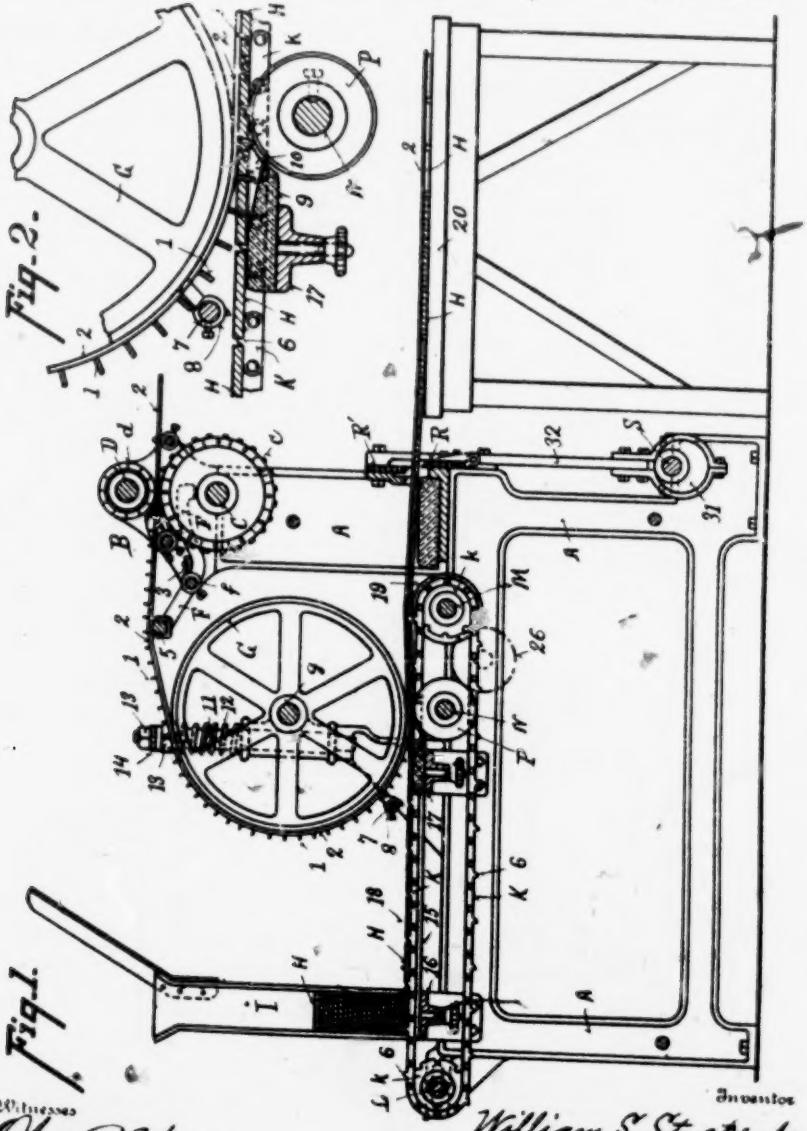


Fig. 2.

Fig. 1.

Witnesses
Chas. B. Hansen
W. R. Wood.

Inventor
William S. Stuckenberg
By C. K. Miller
Attorney

No. 659,772. Patented Oct. 16, 1900.

W. S. STUCKENBERG.

BOX FORMING MACHINE.

(Application filed Feb. 19, 1900.)

(No Model.) 3 Sheets—Sheet 2.

Fig. 3.

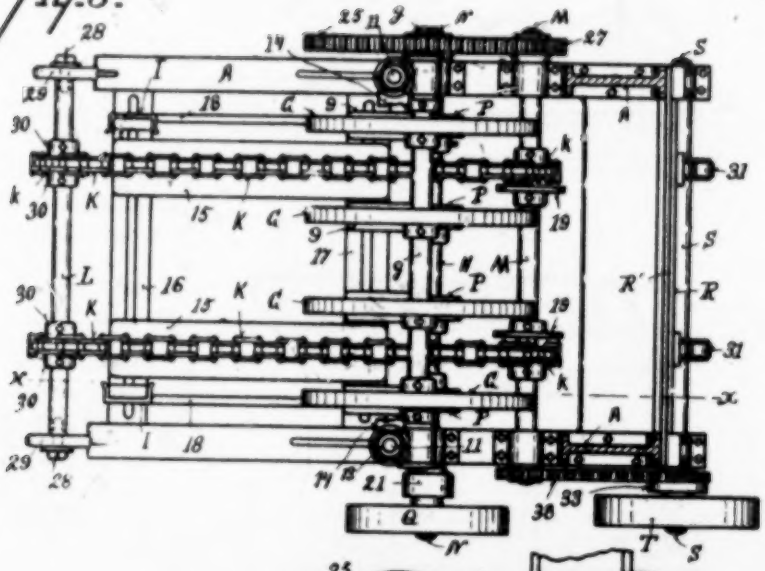


Fig. 4.

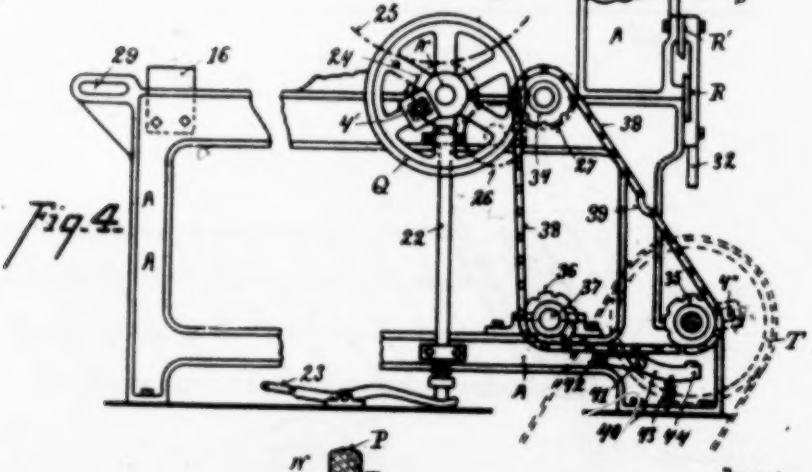
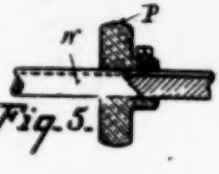


Fig. 5.



Witnesses
Oliver B. Keim
N. B. Wood

Inventor
William S. Stuckenberg
By C. W. Miles.
Attorney

No. 659,772. Patented Oct. 16, 1900.

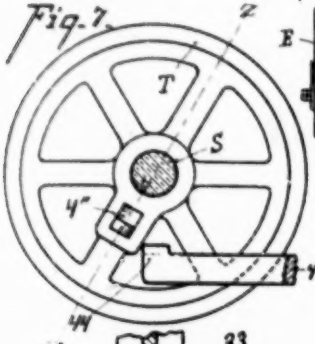
W. S. STUCKENBERG.

BOX FORMING MACHINE.

(Application filed Feb. 10, 1900.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 7.



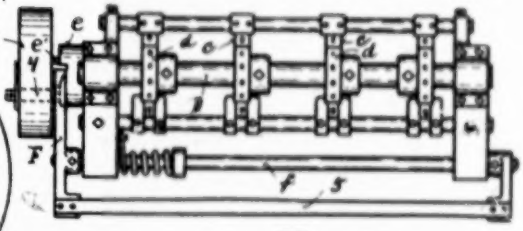


Fig. 6.

Fig. 12.

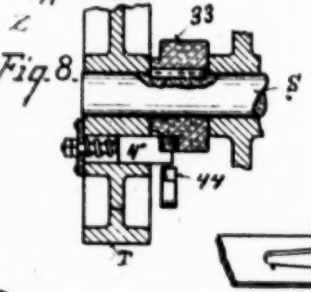


Fig. 8.

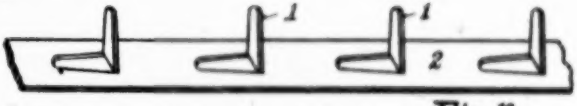


Fig. 13.

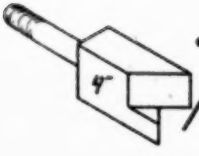


Fig. 9.

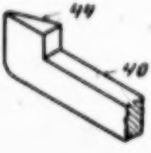


Fig. 10.

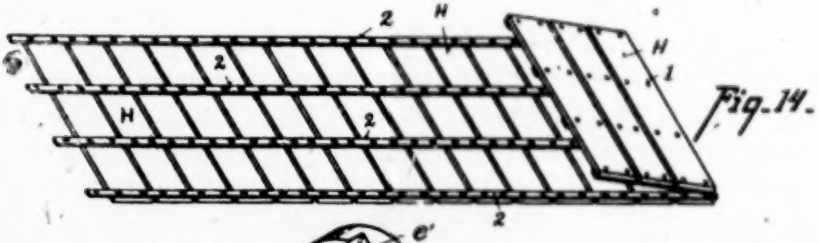


Fig. 14.

Fig. 11.

Witnesses
Oliver B. Keiser
W. R. Wood

Inventor
William S. Stuckenberg
By C. W. Miller
Attorney

[fol. 1555] United States Patent Office

William S. Stuckenberg, of Indianapolis, Indiana, Assignor to the Metal Bound Package Company, of Illinois

Box-forming Machine

Specification Forming Part of Letters Patent No. 659,772, Dated October 16, 1900

Application Filed February 19, 1900. Serial No. 5,731. (No model.)

To all whom it may concern:

Be it known that I, William S. Stuckenberg, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented certain new and useful Improvements in Box-Forming Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in mechanism for making boxing material. One of its objects is to provide mechanism by means of which slats or continuous sheets of veneer may be bound with metal strips to form the siding for boxes.

Another object is to provide mechanism by means of which engaging lugs are stamped up from the metal strips and strips and slats or sheets immediately fed through the machine, whereby the lugs are automatically driven into the slats and clenched, binding the whole into sections suitable for forming the siding of boxes.

Another object is to provide mechanism for automatically and continuously feeding the material and carrying on the above-named operations.

Another object is to provide mechanism for automatically and independently controlling the feed of the stamping mechanism to deliver the stamped metal as required to the driving and clenching mechanism.

Another object is to provide mechanism automatically controlled to cut the continuous sheet of box siding into

sections of the desired length and also means whereby the cut-off mechanism may be set to automatically cut off sections of any desired length.

My invention also further consists in several detail combinations and devices whereby the general result is facilitated, all of which will be more fully set forth in the description of the accompanying drawings, forming part of this specification, in which—

Fig. 1 is a vertical section through my improved mechanism on line *x x* of Fig. 3. Fig. 2 is an enlarged sectional detail view of the driving and clenching mechanism. Fig. 3 is a top plan view, with the stamping mechanism omitted. Fig. 4 is a side elevation showing the manner of intermittently driving the cut-off mechanism. Fig. 5 is a central vertical section through one of the clenching-rolls. Fig. 6 is a top plan view of the stamping mechanism, showing the automatic feed-controlling mechanism. Fig. 7 is a side elevation of one of the clutch-wheels. Fig. 8 is a section through the same on line *z z*, Fig. 7. Fig. 9 is a perspective view of the clutch-dog from one of the clutch-wheels. Fig. 10 is a detail perspective view of the end of one of the levers for tripping the clutch-dogs. Fig. 11 is a perspective view of one of the clutches. Fig. 12 is a perspective view of a section of the slat-feeding chain. Fig. 13 is a perspective view of a section of one of the metal binding-strips with the binding-lugs stamped up therefrom. Fig. 14 is a perspective view of one of the finished sections of box siding.

A represents the frame of the machine.

B represents the mechanism for stamping up the lugs 1 from the metal strips 2. As shown, this mechanism consists of shafts C D, carrying, respectively, a series of male and female stamping rolls *c d*, between which the plain metal strips are fed and the lugs struck up at intervals therefrom.

E represents the driving-pulley, which is loose upon the shaft C and is automatically engaged and released from the clutch members *e* by means of a lever F, which is mounted on shaft *f* and normally held so as to trip the dog 4 and prevent it from entering the notch *e'* in the clutch e. When pressure is brought to bear upon the cross-bar 5 through the tightening of the metal strips resting thereon, the lever

F is drawn out of the path of the dog 4, allowing the dog to catch the notch in the clutch *e* and drive the rolls to feed in more of the strips. This stamping mechanism is independently driven and is speeded somewhat faster than the remainder of the mechanism, so as to thus automatically supply the stamped strips as fast as and only as required. This stamping mechanism may be of any approved pattern which can be automatically controlled, as described, to supply the stamped strips to the remaining mechanism as required. From the stamping mechanism the strips 2 are [fol. 1556] fed over the rolls G and brought in contact with the slats H, which slats are fed consecutively from a hopper I by means of chain belts K, passing over sprocket-wheels k on the respective shafts L M. The alternate links of this belt are provided with spurs 6, which catch the edge of the bottom slat as they pass and feed the slats forward.

7 represents a rod, to which guides 8 are secured to guide the strips 2 centrally beneath the rolls G.

N represents a shaft carrying a series of rolls P, coacting with the rolls G, and between which and the rolls G the slats and binding-strips are fed.

9 represents plates resting beneath the slats in front of the rolls P to support the slats while the lugs 1 are being driven through the slats, slots or grooves 10 being cut in these plates, so that the points of the lugs may project through the slats without being bent. When the projecting points of these lugs come in contact with the faces of the rolls P, they are bent over or clenched, as indicated in Fig. 2. The faces of the rolls P are preferably curved or crowned in order to clench the lugs well into the faces of the slats.

In order that the rolls G may exert a yielding presure and accommodate any inequality in the thickness of the slats, the shaft *g* is mounted in boxes, which are supported upon studs 11 and held in place by means of springs 12 and locknuts 13. The upper ends of the studs are connected by means of a cross-bar 14.

15 represents plates adjustable upon the cross-bars 16 17 to support the under sides of the chains K in feeding the slats forward from the hopper. The plates 9 are also secured to and adjustable upon the cross-bar 17, and the

sprocket-wheels k and rollers G P are all adjustable upon their respective shafts, so as to enable slats of different lengths to be employed.

18 represents guideways for the ends of the slats, also adjustable on the cross-bars 16 17.

After passing the rolls G P the slats are lifted from the chain sufficiently to clear the teeth 6 by means of disks 19 on shaft M, as shown in Fig. 1, and are then fed between the shear-blades R R′ and out upon the table 20.

The shafts *g* N M are driven through the following instrumentalities: Q represents an independently-driven pulley similar to pulley E, provided with a dog 4′ and mounted loosely on the shaft N. 21 represents a clutch similar to *e*, rigid upon shaft N. 22 represents a tripping-rod operated by a treadle 23 to throw the dog 4′, and thus stop or start the feed. Upon the opposite end of the shaft N is a gear 24, driving shaft *g* through gear 25 and also driving an idler-gear 26, which in turn drives gear 27 on shaft M. The rod L does not revolve, but is adjustable to or from the shaft M by means of bolts 28, passing through slots 29 in the frame A. The sprocket-wheels *k* journal on the rod L and are held to the adjusted position by collars 30.

The lower shear-blade is driven at appropriate intervals to cut the sheet of boxing material into sections of the desired length in the following manner: S represents a shaft carrying eccentrics 31, which reciprocate the shear-blade R through the connecting-rods 32. Upon one end of shaft S is an independently-driven pulley, T, similar to pulley E and carrying a dog 4″. A clutch 33 similar to clutch *e* is secured to the shaft S. 34 represents a sprocket-wheel mounted on and driven by shaft M. 35 represents a sprocket-wheel loosely journaled on shaft S. 36 represents an idler sprocket-wheel mounted upon the adjustable stud-shaft 37. 38 represents a chain belt passing over the wheels 34 35 36 and provided with one or more curved links 39. 40 represents a tripping-lever pivoted at 41 to the frame of the machine. One end of this lever is armed with a roller 42, which is pressed upon the chain by means of the spring 43. The opposite end of the lever is provided with a trip 44, normally engaging and holding the dog 4″ out of engagement with the clutch 33. When the curved link 39 comes

opposite the roller, the lever moves, releasing the dog 4″, which causes the shaft S to make one revolution and sever a section of the boxing. By the time the shaft S has completed one revolution the curved link has passed the roller and the trip 44 acts again. In order to cut longer or shorter sections, one or more links are added to or taken from the chain 38 and the stud shaft adjusted to take up the slack in the chain.

Having described my invention, what I claim is—

1. In a box-forming machine the combination of a series of rolls over which the metal strips are fed; anvil-plates supporting the slats while the lugs of the metal strips are being driven; and a series of clenching-rolls in the rear of said plates for bending the ends of the lugs, substantially as specified.

2. In a box-forming machine the combination of a slat-hopper; chain belts for feeding the slats therefrom; a series of rolls for driving the projecting lugs of the binding-strips through the slats; and a series of clenching rolls upon the opposite side of the slats for bending over the ends of the lugs, substantially as specified.

3. In a box-forming machine, the combination of a slat-hopper; chain belts for feeding the slats consecutively therefrom; a series of spring-cushioned rolls for driving the lugs of the binding-strips through the slats; and a series of clenching-rolls for bending over the ends of the lugs, substantially as specified.

4. In a box-forming machine the combination of a slat-hopper; chain belts for feeding the slats therefrom; a series of rolls for driving the lugs projecting from the binding-strips through the slats; anvil-plates supporting the slats while the lugs are being driven; and a series of clenching rolls for bending over the ends of the lugs, substantially as specified.

[fols. 1557 & 1558] 5. In a box-forming machine the combination of a series of driving rolls for driving the lugs projecting from the binding-strips through the wood; anvil-plates supporting the wood while the lugs are being driven; a series of clenching-rolls for bending over the ends

of the lugs; and intermeshing gears causing the driving and clenching rolls to move in unison with each other, substantially as specified.

6. In a box-forming machine the combination of mechanism for stamping up projecting lugs from a series of metal binding-strips; a series of rolls adapted to force the lugs through slats; and a series of clenching-rolls on the opposite side of the slats for bending over the ends of the lugs, substantially as specified.

7. In combination with a series of rolls adapted to drive the projecting lugs of the binding-strips through the slats; and a series of clenching-rolls for bending over the ends of the lugs; means substantially as shown for stamping the lugs from the binding-strips, and a tripping mechanism actuated by the tension on the binding-strips to automatically stop and start the stamping mechanism, substantially as specified.

8. In combination with a slat-hopper, chain belts for feeding the slats therefrom; a series of driving-rolls for driving the lugs projecting from the binding-strips through the slats; and clenching-rolls for bending over the ends of the lugs; means substantially as described for stamping the lugs from the binding-strips; and a tripping mechanism actuated by the tension on the binding-strips to automatically stop and start the stamping mechanism, substantially as specified.

9. In combination with a slat-hopper; chain belts for feeding the slats therefrom: a series of driving-rolls for driving the lugs projecting from the binding-strips through the slats; and clenching-rolls for bending over the ends of the lugs; an independently-driven stamping mechanism for stamping the lugs from the binding-strips; and a tripping mechanism actuated by the tension of the binding-strips to automatically stop and start the stamping mechanism, substantially as specified.

10. In a box-forming machine the combination of a series of rolls adapted to drive the projections of the binding-strips through the slats; clenching-rolls adapted to bend the ends of the lugs over; and intermittently-operated shears

adapted to sever the sheet of boxing material into sections of the required length, substantially as specified.

11. In a box-forming machine the combination of a series of rolls adapted to drive the projections of the binding-strips through the slats; clenching-rolls adapted to bend the ends of the lugs over; independently-driven, and intermittently-operated shears; and means substantially as described for tripping and operating the shears in unison with the movements of the driving and clenching rolls, substantially as specified.

12. In a box-forming machine the combination of a slat-hopper; chain belts for feeding the slats therefrom; a series of rolls for driving the lugs projecting from the binding-strips through the slats; clenching-rolls for bending over the ends of the lugs; shears adapted to sever the boxing material into sections of predetermined length; and means substantially as shown and described for tripping the shears in unison with the movements of the driving and clenching rolls, substantially as specified.

13. In a box-forming machine the combination of mechanism for stamping up lugs from the binding-strips; a series of rolls adapted to drive the lugs through the wood of the slats or sheets; a series of clenching-rolls adapted to bend over the ends of the lugs; and means substantially as described for severing the sheet of boxing material into sections, substantially as specified.

14. In a box-forming machine the combination of mechanism for stamping up lugs from the binding-strips; a slat-hopper; chain belts for feeding the slats therefrom; a series of rolls for driving the lugs through the slats; a series of clenching-rolls adapted to bend over the ends of the lugs; and means substantially as described for severing the sheet of boxing material into sections, substantially as specified.

15. In a box-forming machine the combination of independently-driven mechanism for stamping up lugs from the binding-strips; tripping mechanism actuated by the tension of the binding-strips to automatically stop and start the stamping mechanism; a slat-hopper; chain belts

for feeding the slats therefrom, a series of driving-rolls for driving the lugs through the slats; a series of clenching-rolls for bending over the ends of the lugs; independently-driven shears for severing the sheet of boxing material into sections of predetermined length; and means substantially as specified for automatically tripping the shears in unison with the movement of the driving and clenching rolls, substantially as specified.

In testimony whereof I have affixed by signature in presence of two witnesses.

William S. Stuckenberg.

Witnesses: F. J. Kuny, V. C. Keller.

(Here follow side folios 1559 and 1560.)

[fol. 1561] United States Patent Office

Elias M. Averill, of Harrisburg, Michigan.

Shipping-crate

Specification Forming Part of Letters Patent No. 661,481, Dated November 13, 1900

Application filed April 1, 1899. Serial No. 711,333. (No model.)

To all whom it may concern:

Be it known that I, Elias M. Averill, a citizen of the United States, residing at Harrisburg, in the county of Ottawa and State of Michigan, have invented a new and useful Shipping-Crate, of which the following is a specification.

My invention relates to shipping-crates, and particularly to a container for fruit in which produce may be conveyed from the grower to the consumer; and one object in view is to provide a crate, package, or receptacle suitable for maintaining fruit in a properly-ventilated and salable condition, the same being sufficiently simple in construction and adapt-

No. 661,481. Patented Nov. 13, 1900.

E. M. AVERILL.

SHIPPING CRATE.

(Application filed Apr. 1, 1899.)

(No Model.)

Fig. 1.

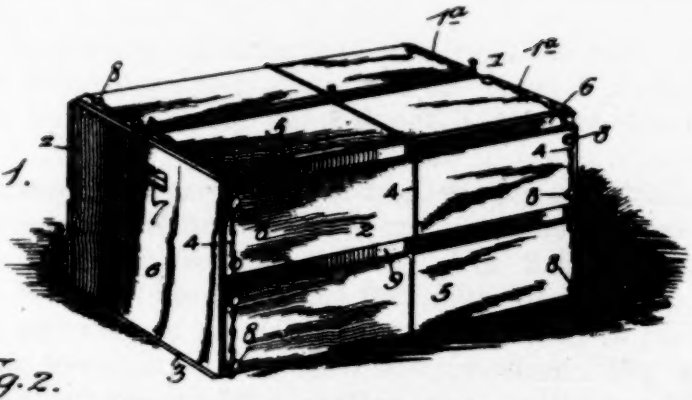


Fig. 2.

Fig. 3.

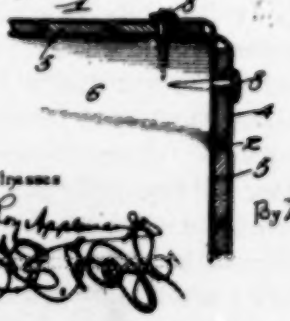
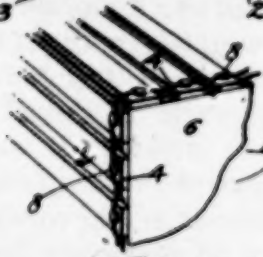


Fig. 4.



Witnesses

Elias M. Averill, Inventor.

By Thos. Allorneys.

Cashow & Co.

ed for manufacture at a sufficiently small cost to justify its conveyance to the purchaser or consumer without additional expense, or, in other words, without charge for the receptacle.

Further objects and advantages of this invention will appear in the following description, and the novel features thereof will be particularly pointed out in the appended claim.

In the drawings, Figure 1 is a perspective view of a fruit-crate constructed in accordance with my invention and embodying the essential features thereof. Fig. 2 is a plan view of the fabric which forms the four sides of the crate. Fig. 3 is an end view of a portion of a crate, partly in section, to show the relation between the warp-wires. Fig. 4 is a detail in perspective of a portion of a crate wherein the side walls are constructed of narrow woof members or strips.

Similar reference characters indicate corresponding parts in all the figures of the drawings.

My invention is capable of embodiment in numerous forms of crates adapted for different uses, such as the transportation of different kinds of fruit and other produce; but for the purposes of illustration I have deemed it necessary in the drawings to show only one form specifically, as in Figs. 1 to 3, inclusive, wherein the top or cover 1, the sides 2, and the bottom 3 are constructed of a single continuous web of fabric, comprising warp members 4, of wire or other flexible material, and woof members 5, consisting of slats of wood veneer or other light material. This web of fabric is secured to and held in place by end walls 6, which are of a size and contour corresponding with the desired cross-sectional shape of the receptacle which is to be constructed. These end walls may be and preferably are of slightly-heavier material than the woof members of the fabric to give stiffness to the receptacle. In the construction illustrated in said Figs. 1 to 3, inclusive, the woof members of the fabric (while the adjacent edges thereof are separated to form intervening ventilating-spaces) are of considerable width, whereby only two, three, or more are required to form each side of the crate, and when said woof members are thus of considerable width I have found it desirable in practice to interlock the warp members there-

with by carrying said warp members through the slats, the latter being suitably softened by steam or otherwise to facilitate the piercing thereof for this purpose. In the intervals between the adjacent edges of the woof members, the warp members, which are arranged in pairs, are crossed or intertwisted, and when, as illustrated in Figs. 1 and 3, the width of the woof members is such as to justify extending the warp members therethrough at intermediate points, said coöperating companion warp members are crossed in the thickness of the woof members, all of the relative turns of the warp members being made in the same direction, so that each warp member lies first outside and then inside of the other warp member. This prevents the independent displacement of one of the warp members. Furthermore, to prevent displacement of the warp members in a direction parallel with the lengths of the slats the former may be put under sufficient tension, while the material of the slats is soft to embed the wires therein. The above-described interlocking connection of the warp members with broad woof members applies particularly to those warp members which are located near the ends of the crate, as it is only at these points that any damaging displacement of the warp members may occur. The intermediate warp members may be engaged with the slats, as shown, without this interlocking or extension through the slats and may be held from displacement by frictional contact of the warp members or [fol. 1562] by the embedding thereof in the surfaces of the slats by the tension applied to the warp members.

In assembling the members of the crate the fabric is arranged with the center of its length at the centers of the lower edges of the end walls, (the latter preferably being pierced, as shown at 7, to form handholds,) and said fabric is then extended toward the side edges of the end walls, thence upward to the plane of the upper edges thereof, and finally inward to form the top sections or members 1^a. The top or cover thus consists of the terminal portions of the fabric which forms the four sides of the receptacle, and at suitable points throughout its length the fabric is secured to the edges of the end walls by means of nails 8 or other fastening devices, which are passed through the perforations formed for the wires, and by utilizing these perforations the woof members are not weakened at other points by perforations for such fastening devices.

In the modified construction illustrated in Fig. 4 the woof members or slats are narrow, thus avoiding the necessity of interlocking the warp members therewith, as by extending said warp members through the slats; but in other respects the construction is identical with that described in connection with Figs. 1 to 3, inclusive. Also the terminal portions of the warp members, or those portions which project beyond the free edges of the terminal slats, may be intertwisted to form a temporary connection between the sections of the top or cover; but when the crate has been filled preparatory to shipping I prefer to secure said top section by means of the nails or other fastening devices above described.

I have found in practice that a crate of the construction described may be manufactured at a sufficiently small cost to justify the grower in supplying them without involving additional expense to the consumer, said crates passing into the possession of the consumer under the same conditions as do the bushel baskets and similar receptacles now in common use as fruit-containers. Also in Fig. 1 I have indicated an intermediate partition 9, parallel with the end walls, to divide the interior of the crate into two compartments; but it will be understood that this feature of construction may be used or not, as may be required, by the kind of fruit to be contained by the receptacle and that the widths of the intervals between the adjacent slats may also be varied to suit the size of the fruit which is to be shipped in a given crate.

It will be understood, furthermore, that while I have illustrated but two constructions of crate embodying my invention the same is susceptible of numerous modifications embodying the essential features above pointed out and that various changes in the form, proportion, size, and the minor details of construction within the scope of the appended claim may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Having described my invention, what I claim is—

A crate comprising parallel walls, and a web of fabric consisting of a plurality of rigid woof members, and warp-wires passed through the woof members in opposite direc-

tions at regular intervals between their side edges and crossed within and between the same and embracing the said woof members, said web being secured to the edges of the walls by fastening devices passed through the perforations for the wires, substantially as described.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

Elias M. Averill.

Witnesses: E. D. Prescott, Henry H. Walker.

(Here follow side folios 1563 and 1564.)

[fol. 1565] United States Patent Office

Robert K. Pollock, of Chattanooga, Tennessee

Fruit or Vegetable Crate

Specification Forming Part of Letters Patent No. 686,329, Dated November 12, 1901

Application filed August 31, 1901. Serial No. 74,049. (No model.)

To all whom it may concern:

Be it known that I, Robert Kelly Pollock, a citizen of the United States, residing at Chattanooga, in the county of Hamilton and State of Tennessee, have invented new and useful Improvements in Fruit or Vegetable Crates or Boxes for General Uses, of which the following is a specification.

My invention relates to improvements in a fruit and vegetable crate or box for general uses; and the object of my improvement is to lessen the labor, and consequently the cost, of constructing a fruit and vegetable crate or box for general uses.

The chief feature of my invention is the manner of the construction of the component parts of the crate or box, which permits of the crate or box being quickly erected without the driving of a single nail; but in order to make it absolutely secure eight nails or staples may be driven

No. 686,329. Patented Nov. 12, 1901.

R. K. POLLOCK.

FRUIT OR VEGETABLE CRATE.

(Application filed Aug. 31, 1901.)

(No Model.)

Fig. 1.

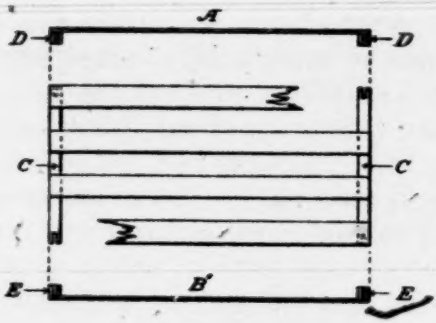


Fig. 2.

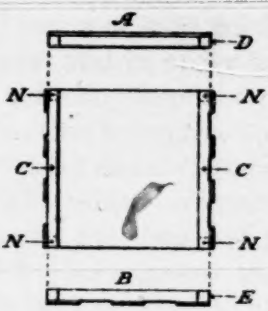


Fig. 3.

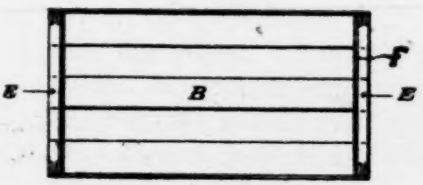


Fig. 6.

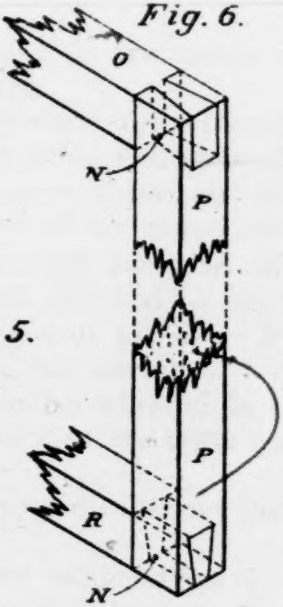


Fig. 4.

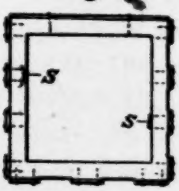
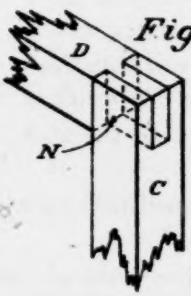


Fig. 5.



WITNESSES:
Frank E. Martin
J. E. MacGowan

INVENTOR:
Robert K. Pollock.

into it after the component parts are connected with each other.

In order to understand the present manner of manufacturing fruit-crates, it may be of value to state that they are not erected at the factory. They are sold in disconnected parts to the grower or shipper, and in order to erect them or get them in readiness for use they must be put together with from forty to fifty nails, which requires a great deal of labor and expense. The present fruit-crate in universal use is sold to the user in eight pieces—namely, two sides, one top and three bottom pieces, and two end pieces. Now in order to erect a crate with these pieces the user is compelled to nail the top, three bottom pieces, and the two sides onto the two end pieces. My invention does away with at least two-thirds of the labor necessary to build the crate now in universal use.

I attain the object of my invention by the means illustrated in the accompanying drawings.

Figure 1 shows a side view of my crate, the top and bottom being shown detached. Fig. 2 is an end view of my crate, the top and bottom being shown detached. Fig. 3 is a horizontal cross-sectional view of my crate. Fig. 5 shows a view of two batten-strips, one provided with a tenon and the other with a mortise adapted to interlock therewith and to be fastened by nails or the like. Fig. 6 shows a view of two batten-strips, one having a dovetail tenon and the other a dovetail mortise adapted to interlock therewith. Fig. 4 is an end view of the crate now in universal use.

Similar letters refer to similar parts throughout the several views.

The side view, Fig. 1, shows two batten-strips C, connected by cross-strips B, secured at their ends to the batten-strips. In the illustration, A is the top, having the batten-strips D, connected by cross-strips B, secured at their ends to the batten-strips. B′ is the bottom of my crate, having two batten-strips E, connected by cross-strips B, secured at their ends to the batten-strips, and the dotted lines show how the top and bottom having tenons upon the batten-strips interlock with the sides having mortises upon the batten-strips. These four walls form the main body

of my crate, and they are placed together by knocking the tenon into the mortise, or vice versa. The crate thus erected is quite substantial; but to fasten it more securely four nails may be driven in at the point of interlock of the batten-strips through the tenons and mortises, as shown in Figs. 5 and 6, the nails being designated by the letter N.

The ends of my crate consist each of an integral plate or sheet (designated by the letter F in Fig. 3) adapted to be positioned against the inner face of the interlocked batten-strips and to be held in place merely by the contents of the crate. There is no nailing whatever of the ends of my crate.

Now as to the present fruit-crate in universal use, an end view of which is shown in Fig. 4, it will be observed that there are twenty-four nails in this end, or in the two ends of the crate there would be forty-eight nails. The two ends of the old crate disconnected from the sides, bottom pieces, and top are furnished to the consumer fastened together, (there being almost as many nails in them as in the balance of the crate,) and then to erect a crate it is necessary to expend much labor in driving forty-eight nails through the two sides, the top, and the three bottom pieces; so where I save labor and expense by my invention is in providing four walls of the crate with batten-strips fastened thereto and only calling for, though not absolutely requiring, the driving of four nails in each end or eight [fol. 1566] nails altogether to secure the crate after the walls have been placed together without the use of nails.

Now as to Fig. 6 as contrasted with Fig. 5, showing an ordinary tenon-and-mortise joint, that view shows how the batten-strips connected to the four walls may be interlocked by a dovetail mortise and tenon in the batten-strips. The batten-strip O has a dovetail tenon, and it will be secured to one wall of the crate. The batten-strip P has a dovetail mortise, which is made in such a manner that it will be impossible to pull the other batten-strip out of the mortised strip lengthwise, though it can be easily removed upward to permit the opening of the crate. The batten-strip R is connected to the bottom wall of the crate, and it has a dovetail tenon which interlocks with the mortise of the batten-strip P, the dovetail mortise in the latter piece being cut in such a manner that the other batten-

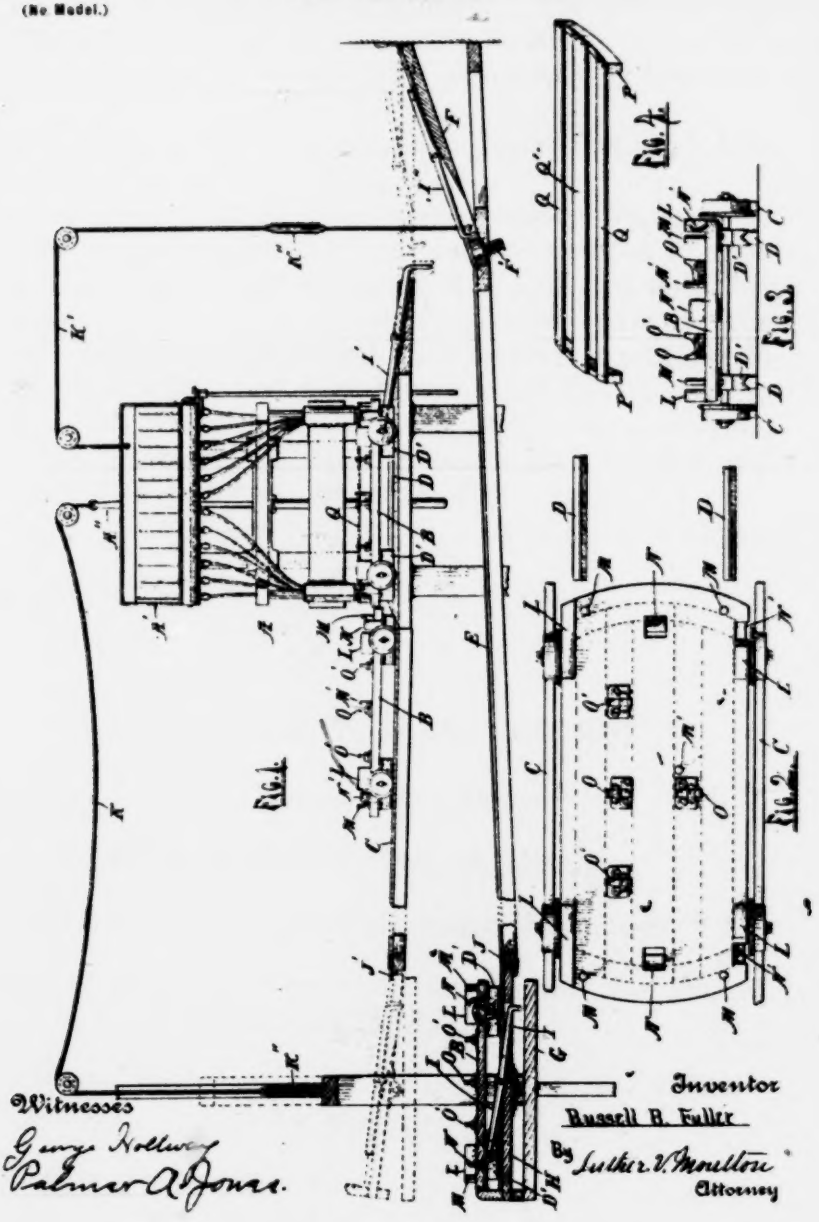
No. 690,416. Patented Jan. 7 1902.

R. B. FULLER.

WORK CONVEYING AND PRESENTING MECHANISM.

(Application filed Jan. 2, 1901.)

(No Model.)



Witnesses
George Hollweg
Palmer A. Jones.

Inventor
Russell B. Fuller
By Luther V. Moulton
Attorney

strip R cannot be pushed out of the bottom of the mortise, though it can be pushed out lengthwise. The interlocking of the batten-strips that way imparts strength to the bottom wall on which the weight of the contents of the crate rest.

What I claim as my invention, and desire to secure Letters Patent, is—

In a knockdown crate, four walls constructed each of two batten-strips connected by cross-strips secured at their ends to the batten-strip, the batten-strips of two walls being provided with a tenon and the batten-strips of the other two walls being provided with a mortise adapted to interlock therewith, and two remaining walls consisting each of an integral plate or sheet adapted to be positioned against the inner face of the interlocked batten-strips and to be held in place by the contents of the crate.

Robert K. Pollock.

Witnesses: Frank G. Martin, R. E. Prichard.

(Here follow side folios 1567 and 1568)

[fol. 1569] United States Patent Office

Russell B. Fuller, of Holland, Michigan

Work Conveying and Presenting Mechanism

Specification Forming Part of Letters Patent No. 690,416, Dated January 7, 1902

Application filed January 2, 1901. Serial No. 41,920. (No model.)

To all whom it may concern:

Be it known that I, Russell B. Fuller, a citizen of the United States, residing at Holland, in the county of Ottawa and State of Michigan, have invented certain new and useful improvements in Work Conveying and Presenting mechanism; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as

will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in means for conveying and holding materials to be operated upon by means of various machines, and more particularly to nailing-machines, stapling-machines, and machines of like nature which are adapted to the manufacture of baskets, boxes, and like structures.

The object of my invention is to provide greater facilities for handling, assembling, and holding the material to be operated upon, whereby a number of operators may work in conjunction with a single machine, thereby greatly increasing the capacity of the same. In operating such machines in the usual way by single operators considerable time intervenes between the strokes of the machine, during which time the operator is assembling and disposing of the work.

My invention consists, essentially, in providing improved means for moving and holding cars having holding means in which to assemble and nail the materials, consisting of tracks or ways for the cars, together with automatically-operated pawls, stops, switches, and other devices, whereby the cars are moved or held so that a number of operators may work in conjunction with a single machine, and thus greatly increase the output from the same. My device also consists in certain details of arrangement and construction hereinafter more fully described, and particularly pointed out in the claims, reference being had to the accompanying drawings, in which—

Figure 1 is a front elevation of a device embodying my invention with parts removed to show the construction; Fig. 2, an enlarged plan view of a car adapted for holding the basket-covers shown in Fig. 4; Fig. 3, an end elevation of the car, and Fig. 4 the particular form of basket-cover for which the car shown is adapted.

Like letters refer to like parts in all the figures.

A represents a nailing-machine as ordinarily constructed.

B represents any convenient number of cars of suitable size and shape and provided with devices to hold the work to be nailed, the form shown being adapted to hold basket covers made as shown in Fig. 4.

C is a suitable track of any convenient length extending from the elevator G to the machine A. This track should in

practice be of such length that a number of persons could work at assembling the material upon the cars sufficient to keep the machine operating to its full capacity. This track should also have an inclination toward the machine to cause the cars to move forward by gravity. The bed-plate of the machine is provided with V-ways D to engage V-grooved blocks D′ on the cars, whereby the cars are caused to come accurately to place laterally and are firmly supported under the nailing mechanism and also by friction held from moving as the nails are driven. To longitudinally locate the cars, a pawl I′ is provided, which engages a projection on each car in succession, preferably the forward axle thereof. The pressure of the cars on the inclined track C holds the car on the machine firmly against the pawl I′ and runs it off the machine and upon the pivoted section F when said pawl is released.

At the side of the nailing-machine opposite the track C a section of track F is provided, which section is hinged to turn downward at the end adjacent to the machine. This track is raised to a horizontal position by means of a cord K′, attached to some reciprocating part of the machine, preferably to the nail-basket A′. The pawl I′ is engaged by the movable end of this section of track F and released from engagement with the car to permit the same to run forward upon the said section F. To insure complete closure of the section F, a contractile spring K″ is inserted in the cord K′, which spring yields after the section is closed. To avoid premature release of the car, the end of [fol. 1570] the pawl I′ is turned downward and engaged by a yielding spring F′ on the section F. This spring trips the pawl I′ after the nailing operation is completed.

I″ is a pawl pivoted on the section F, which engages and holds the car after it runs upon the said section and until the end of the section is sufficiently lowered to connect with the upper end of an inclined track E, extending beneath the bed of the machine and the track C to the elevator G. The pawl I″ is released by engaging the support for the movable end of the section F.

G is a vertically-movable elevator operated by a cord K, attached to a reciprocating part of the machine, preferably the nail-basket A′ This cord is provided with sufficient slack to permit the elevator to reach its lower position early enough to receive the car released by the simultaneous

lowering of the section F. This cord is also provided with a spring K″ to yield after the elevator has reached its upper position, and thus insure proper operation should the cord stretch. To insure sufficient movement of the cord, an Arm A″ may be extended from the basket A′, to which the cord may be attached.

Supported by the elevator G and pivoted a short distance above the same is a tilt-table H, adapted to receive the cars from the track E and also provided with a pawl I to hold the cars on the table. When the elevator is in lowered posi-ion, the table H engages a stop J on the end of the track E, which stops the elevator and hold the table in line with the track E. As the elevator rises a stop J on the end of the track C engages the end of the table H and presses the same down against the elevator, thus tilting the table and releas-ing the car by engaging the pawl I with the elevator. This inclination of the table H causes the car to run off the table and upon the track C. The cars thus automatically run from the machine upon the section F, are lowered upon the track E, run down the said track and upon the elevator, and are raised and deposited in series upon the track C, from whence they proceed by gravity and in succession through the machine. At each stroke of the nailing ma-chine a car is released therefrom and another takes its place, being pushed forward upon the V-ways by the cars on the track C. By stationing a sufficient number of per-sons alongside the track C to place material on the cars and another near the section F to remove the work from the cars as they leave the machine it is evidence that no other manual labor is needed and the machine may be worked very rapidly. For illustration I have shown a basket-top in Fig. 4 made of end segments P P and two side strips Q Q and a middle strip Q′. I have also shown a machine adapted to nail the strips to the segments, a car having the general outlines of the top shown in Fig. 4 and being pro-vided with pins M, side springs N, and end springs N′ to hold the segments P, and also with side blocks L and spring-clips O O to hold the side strips Q, and a pin M′ and spring-clips O′ O′ to hold the middle strip Q′; but I do not limit my invention to these particular forms. Cars of proper shape and having proper means for holding parts of boxes or other articles differing from the cover shown in

Fig. 4 can readily be substituted without departing from the essence of my invention.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination of two oppositely-inclined tracks, an elevator at the diverging ends of the tracks, a pivoted section of track at the converging ends of the tracks, and means for reciprocating the elevator and pivoted section, substantially as described.

2. The combination of two oppositely-inclined tracks, an elevator at the diverging ends of the tracks, a tilt-table on the elevator, a stop on the upper track to engage and tilt the table, means for operating the elevator, and means at the opposite ends of the tracks for shifting cars from the upper track to the lower track, substantially as described.

3. The combination of two oppositely-inclined tracks, located one above the other, an elevator at the diverging ends of the tracks, a tilt-table on the elevator, a stop on each track to engage the tilt-table, a pivoted section of track at the converging ends of the tracks, a pawl on the pivoted section, and means for operating the elevator and pivoted section, substantially as described.

4. The combination of an elevator, a track inclined away from the elevator, a track inclined toward the elevator, means of transferring cars from the first-named track to the other track, a tilt-table, stops on the respective tracks to engage the tilt-table, and means for operating the elevator, substantially as described.

5. The combination of an elevator, a tilt-table on the elevator, a pawl on the tilt-table, a track inclined from the elevator, a stop on the track to engage the table, a section of track at the opposite end of the inclined track, said section being pivoted at one end and vertically movable at the other end, a track extending from the movable end of the said section to the elevator and inclined toward the elevator, a stop on said track, and means for operating the elevator and pivoted section, substantially as described.

6. The combination of an elevator having a tilt-table to receive the cars and a pawl to hold the same, a track extending from the elevator to a pivoted section at the opposite

end of the track and vertically movable at one end, a pawl on said section to engage the cars, a track extending from the pivoted section to the elevator, a pawl to stop the cars [fols. 1571 & 1572] on the first-named track, and means for operating the pawls, the elevator, and the pivoted section, substantially as described.

7. The combination of an elevator having a tilt-table, a pawl pivoted to the table, a track extending from the elevator, a stop on the track to engage the pawl, a pawl to engage a car on the said track, a pivoted section to receive the cars and engaging the last-named pawl, a pawl on the pivoted section, a track extending from the said section to the elevator, a stop on the track to engage the tilt-table, and means for operating the elevator and pivoted section, substantially as described.

8. The combination of a machine having ways, a track inclined toward the ways, a series of cars having wheels to traverse the track, blocks on the cars to engage the ways and support the cars, and means for returning the cars to the upper end of the inclined track, whereby the cars are propelled by gravity over the track and ways, substantially as described.

9. The combination of a machine having ways to support the cars and a pawl to stop the cars on the ways, an inclined track leading to the ways, a series of cars having wheels to traverse the track, blocks on the cars to engage the ways, and means for returning the cars to the upper end of the inclined track, substantially as described.

10. The combination of a machine having ways to support the cars, and a pawl to stop the cars on the ways, an upper inclined track at one side of the machine, a pivoted section of track at the other side of the machine, a lower inclined track extending from the pivoted section and beneath the ways and upper track, means for shifting cars from the lower track to the upper track, cars having wheels to traverse the tracks, and blocks on the cars to engage and traverse the ways, substantially as described.

11. The combination of a machine having ways, a pawl to stop the cars on the ways, an upper inclined track at one side of the machine, a pivoted section of track at the other

side of the machine and operating the pawl, a pawl on the pivoted section, a lower inclined track extending from the pivoted section and beneath the ways and upper track, an elevator to shift cars from the lower to the upper track, means for operating the pivoted section and elevator, cars having wheels to traverse the various tracks, and blocks on the cars to engage and traverse the ways, substantially as described.

12. The combination of a machine, having a reciprocating member, cars adapted to hold and convey the stock to be operated upon by the machine, an elevator, and a pivoted section of track, means for connecting the elevator and pivoted section to the reciprocating member of the machine, a track extending from the elevator to the machine, and a track from the pivoted section to the elevator, substantially as described.

13. The combination of a machine having a reciprocating member, cars to hold and convey stock to the machine, an elevator having a tilting table and pawl to secure the cars, a cord having an elastic portion and connecting the elevator and said member, a track from the elevator to the machine, a stop to operate the tilt-table and pawl, a pawl on the machine to stop the cars, a pivoted section of track to receive the cars and engaging the pawl, a cord having an elastic portion and connecting the pivoted section and said member, and a track from the pivoted section to the elevator, substantially as described.

14. The combination of a nailing-machine, having a reciprocating nail-basket, cars having means for holding the stock to be nailed, an elevator, a track from the elevator to the machine, a pivoted section of track vertically movable at the end toward the machine, a track extending from the pivoted section to the elevator, a cord extending from the elevator to the nail-basket, a cord extending from the pivoted section to the nail-basket, and springs in the cords, substantially as described.

15. In combination with a nailing-machine, and means for conveying cars in succession to the machine, a car having pins and springs to hold the end segments of a basket-top, and side blocks and spring-clips to hold the strips of the same, substantially as described.

16. In combination with a nailing-machine, ways on the machine, a circuit of tracks to convey cars from one end of the ways to the other end of the same, a car having wheels to a traverse the tracks, blocks on the car to engage the ways, means attached to the car for holding the segments and strips of a basket-top, and means for automatically moving the car over said tracks and ways, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

Russell B. Fuller.

Witnesses: Luther V. Moulton, Palmer A. Jones.

(Here follow side folios 1573 and 1574.)

[fol. 1575] United States Patent Office.

Russell B. Fuller, of Holland, Michigan

Work Conveying and Presenting Mechanism

Specification Forming Part of Letters Patent No. 694,467, Dated March 4, 1902

Application filed April 5, 1901. Serial No. 54,564. (No model.)

To all whom it may concern:

Be it known that I, Russell B. Fuller, a citizen of the United States, residing at Holland, in the county of Ottawa and State of Michigan, have invented certain new and useful Improvements in Work Conveying and Presenting Mechanism; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in mechanisms for conveying and presenting the materials to be operated upon to nailing-machines, presses, and like machines; and the particular device herein shown and illustrating my

No 694,467. Patented Mar. 4, 1902.

R. B. FULLER.

WORK CONVEYING AND PRESENTING MECHANISM.

(Application filed Apr. 8, 1901.)

(No Model.)

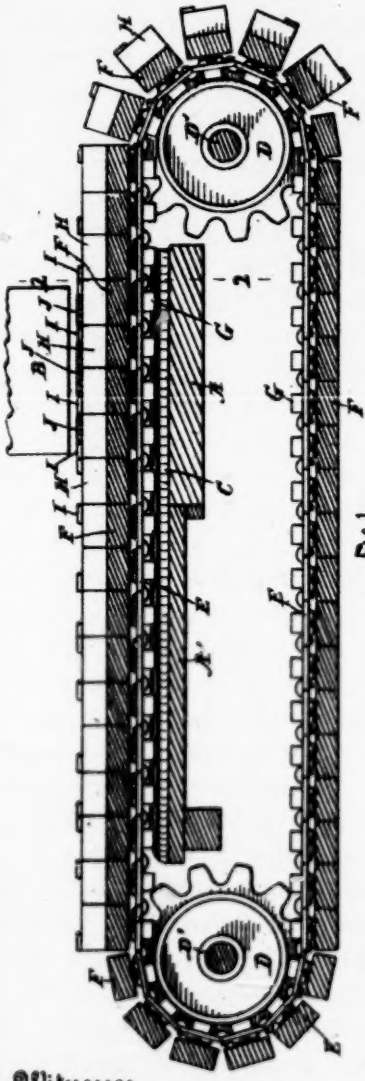


Fig. 1.

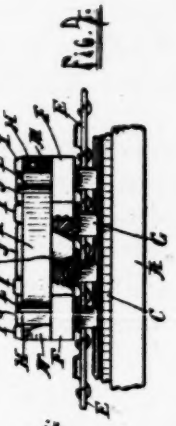


Fig. 2.

Fig. 3.

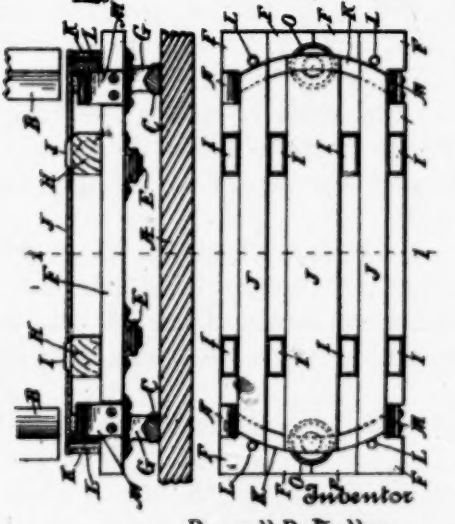


Fig. 4.

Witnesses
Palmer A. Jones.
F. B. Wheeler

Inventor
Russell B. Fuller
By Luther V. Moulton
Attorney

invention is especially adapted to operate in conjunction with a nailing-machine, and the material operated upon, as shown, is basket-tops to be used with what is commonly known as the "Climax" fruit-basket.

The object of my invention is to provide the automatic means for conveying the stock to be operated upon with improved means for holding the same in place while being nailed or otherwise operated upon by the machine and automatically releasing and discharging the stock after it has been operated upon.

My invention consists, essentially, in providing the machine having an endless belt or apron consisting of narrow transverse slats flexibly connected in series and traversing the bed of the machine and providing certain groups of these slats with improved holding means to engage the opposite sides of material to be operated upon and in certain details of construction and arrangement of parts, as hereinafter more fully described, and particularly pointed out in the claims, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal vertical section of a device embodying my invention, taken on the line 11 of Figs. 2 and 3; Fig. 2, a transverse section of the same on the line 2 2 of Fig. 1; Fig. 3, a plan of one group of slats and the stock supported thereby; Fig. 4, an end elevation of the same with a part broken away, and Fig. 5 a perspective of a finished basket-top.

Like letters refer to like parts in all the figures.

A represents the bed or table of a nailing-machine, press or other analogous machine; B, the nailing-head or other operating member of the machine adapted to nail or otherwise operate upon the stock.

A′ is an extension of the bed A, above which extension the stock is placed and assembled in the holders.

C C are V-tracks on the beds A and A′, on which tracks the apron is movably supported. This apron consists of a continuous series of transverse slats F, attached to the links of endless sprocket-chains E, one slat to opposing links in the respective chains.

At each end of the bed or table A A′ are sprocket-wheels D, engaging the sprocket-chains E and mounted on shafts D′ D′, one of which shafts is provided with any convenient means (not shown) of imparting intermittent rotary motion

thereto sufficient to carry the apron forward at each movement a suitable distance to successively bring each basket-top or other article under the member B.

Upon the bottom of each slat F are blocks G, having V-grooves to fit the track C and slide thereon. These blocks and tracks also afford a solid support to sustain the pressure or blow exerted by the member B. In the device shown, each successive group of four slats constitute a section adapted to hold the material for a basket-top and is provided with the following means for holding the same: blocks H, having projections I to engage the respective sides of the top strips J and hold the same in place, posts N to engage the ends of the segments K, springs M to engage the ends of the segments opposite the posts N. These posts N and springs M are attached to the outer sides of the outer slats of the group and upwardly-projecting pins L also inserted in the slats to engage the outer side of the segments K and properly locate the same. Beneath the middle of each segment is a conical thimble O to receive a long nail [fol. 1576] P, used to secure the top in place on the basket. These thimbles are embedded in the adjacent sides of the middle slats, (of the group of four,) one-half in each, and secured to one slat only by a suitable screw or fastening, as shown in Fig. 4.

The extension A′ and the apron are made of sufficient length to accommodate a sufficient number of operators to place the stock in the holders as the apron traverses the extension A′. The segments K and top strips J will all be securely held as long as the apron is in a horizontal plane, and when a group of slats pass over the sprocket-wheels D said slats are separated and project radially from the axis of the shaft D′. This position separates the holding means and automatically discharges the stock therefrom.

From the foregoing description the operation of my device will be readily understood without further explanation.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination of sprocket-chains, wheels engaging the chains, transverse slats attached to opposing links in the chains and arranged in groups, posts attached to a slat at one side of the group, springs attached to a slat at the op-

1577-1578

No. 722,423. PATENTED MAR. 10, 1903.

J. H. GREENSTREET.

BOX OR PACKAGE AND MATERIAL THEREFOR.

APPLICATION FILED MAR. 21, 1898.

NO MODEL.

Fig. 1.

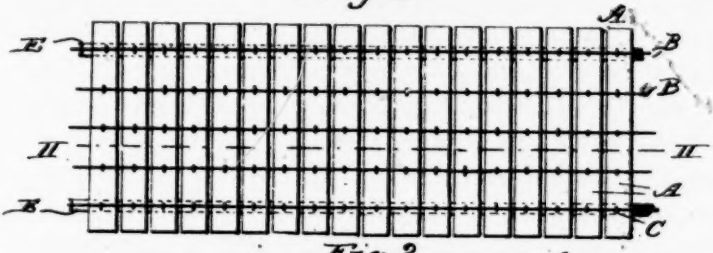


Fig. 2.

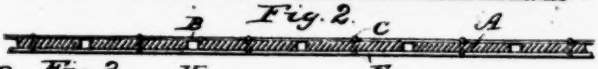


Fig. 3.

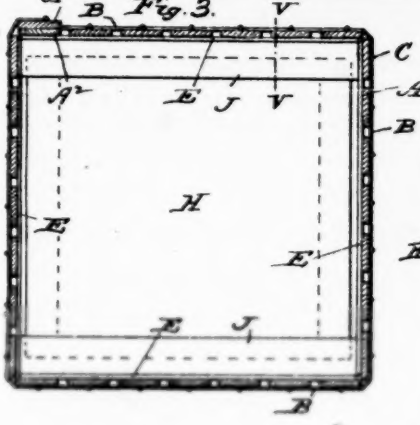


Fig. 4.

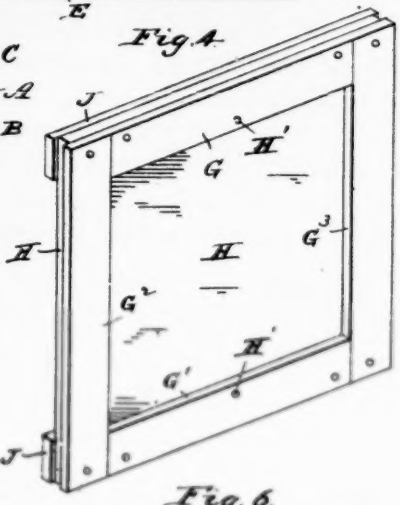


Fig. 5.

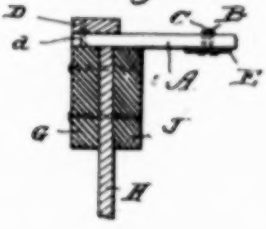
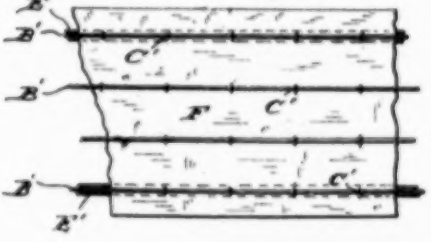


Fig. 6.



Witnesses:

Geo. B. Pitts

G. S. Barker

Inventor:

James H. Greenstreet

by H. N. Low Atty.

posite side of the group, pins in the slats, and blocks on the respective slats and having upward projections to engage opposite sides of the stock, substantially as described.

2. In combination with a nailing-machine, an endless apron, consisting of transverse slats pivotally connected to each other and arranged in groups of four, one slat having posts pins, and blocks, to engage one side of the stock, one slat having springs, pins, and blocks to engage the opposite side of the stock, two of said slats having blocks to engage the stock, and thimbles between the middle slats and attached to one of the same, substantially as described.

3. The following means for holding basket-tops to be nailed: four slats pivotally connected to each other in series, posts at one side of the series to engage the ends of the segments, springs at the other side of the series to engage the opposite ends of the segments, pins in the outer slats to engage the outside of the segments, and blocks on each slat having upward projections to engage the opposite sides of the top strips, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

Russell B. Fuller.

Witnesses: Jos. H. Schueller, Palmer A. Jones.

(Here follow side folios 1577 and 1578)

[fol. 1579] United States Patent Office

Jason H. Greenstreet, of Indianapolis, Indiana

Box or Package and Material Therefor

Specification Forming Part of Letters Patent No. 722,423, Dated March 10, 1903

Application Filed March 21, 1898. Serial No. 674,599. (No model.)

To all whom it may concern:

Be it known that I, Jason H. Greenstreet, a citizen of the United States, residing in Indianapolis, in the county of

Marion and State of Indiana, have invented a new and useful Improvement in Boxes or Packages and Materials Therefor, of which the following is a specification.

This invention relates to a construction of box material for wire-bound boxes made of thin or veneer stock and to the construction of the boxes themselves, and has for its object the production of a box of this kind which is not only better than those heretofore made, but is also cheaper to make.

The nature of the invention is fully disclosed in the description which I give below and in the accompanying drawings, forming a part of this specification.

In said drawings, Figure 1 is a plan view of a sheet of combined metal and wood from which the sides and top and bottom of the box may be made, the same embodying my improvements. Fig. 2 is a sectional view of the same on line II, Fig. 1. Fig 3 is a transverse vertical section of the box made according to my invention. Fig. 4 is a detail perspective view of the end part of the box detached. Fig. 5 is a sectional view of one of the box-corners, on a larger scale, on line V, Fig. 3. Fig. 6 is a plan view of a modified construction of the box material, also embodying the invention, in which a sheet of thin wood or veneer is employed in place of separate slats.

In said drawings, A represents the slats of which the combined wood and metal sheets may be chiefly composed. They are formed of wood and are thin and may be and preferably are cut into the proper size from veneer stock. They are united together to form a long or continuous sheet or fabric, which may be cut into lengths, each adapted to form the sides, top, and bottom of the boxes by means of exterior continuous wires B, laid transversely of the slats A and secured to each of them by staples C, the ends of which are bent down or clenched. As thus far described the fabric is not new; but I have found in practice that the wires B are apt to kink up or buckle between the staples and injure the looks of the fabric, as well as change its longitudinal dimensions. To remedy this, I have been led to combine with the fabric a stay or expansion-strip E of wood, which is laid trasversely of the slats and parallel with the wires and stapled to the slats by the wire-securing staples C. This stay or expansion-strip holds the slats

at the relative positions they occupy when they are first secured to the wires and keeps the wires extended or drawn out to their full length, thus avoiding the kinking or buckling referred to. The stay may either be a strip applied mainly or solely for this purpose, or the function may be devolved upon outside cleats secured to the wires and slats in the described manner. The stays may be inside the box, as shown, the fabric being bent in the direction to effect such arrangement. The stays are shown as located along those wires which are nearest the ends of the slats. The stays when thus applied within the box are preferably of light stuff and may be even thinner than the slats themselves. I also use the stays with large veneers F, as shown in Fig. 6, having similar wires B′ stapled thereto at intervals by staples C′. In this case the stays E′ may be either inside or outside and are applied in line with the wires, and they serve in this form of the invention to prevent any buckling of the wires being caused by the shrinking of the veneer. Such shrinking would tend unless thus restrained to move the staples closer together and to bend the wires between the staples. By means of these stays the full length of the fabric is maintained after it is made up into the box, and the box does not lose its original dimensions nor become unsightly.

The closure of the box may be affected in any desirable way or at any desirable point; but I prefer to use the way illustrated. In Fig. 3 the line of division between the ends of the fabric forming the top, sides, and bottom of the box is at or near one of the upper corners, and the fabric is cut long enough so that one or more of the slats A′ and A² at each end of the fabric may lap by each other and be positioned one above the other and be properly nailed to the [fol. 1580] box ends in that position. To permit this lapping, the stays may be omitted or cut off from the lapping slats. I prefer that there be two lapping slats at each end, as that renders theft of the contents of the box more difficult. I sometimes locate the dividing-line between the ends of the fabric at other points than the point shown in Fig. 3.

The ends of the box may be constructed in any of the ordinary ways; but I prefer to use in a large proportion of the cases the following: G, G′, G², and G³ are pieces of

lumber forming an exterior frame the size and shape desired for the end, the pieces G^2 and G^3 extending across the pieces G and G'. Inside of this frame a filling H of veneer or a portion of the fabric above described sufficient in size to cover the opening in the frame may be positioned, and inside the veneer or fabric are pieces J, positioned so as to break the joints between the pieces of the outside frame and suitably secure to said frame. A continuous inside frame like the outside one and positioned to break joints therewith may, however, be used instead of strips J, if preferred, as indicated by the broken lines in Fig. 3. The veneer or fabric is clamped between the outside frame and the strips, (or the inside frame,) and in order to prevent splitting of the veneer I prefer to nail it only at the center, as seen at H'.

It will be noticed that the box can be supplied in the knockdown condition. The top, bottom, and sides being in one piece, by reason of the binding-wires and expansion-strips, can be shipped in the flat, and the sheet or fabric from which they are cut can be made in continuous lengths limited only by the lengths of the wires and strips.

Wherever I have used the word "veneer" in my description or claims as applied to the thin material from which portions of the box or package are made it will be understood that I do not limit myself to what is strictly known as "veneer" stock, as evidently any thin stuff produced by sawing might be used instead of veneer. It will also be understood that I do not wish to be limited in my claims to what are strictly known as "boxes," as the invention is capable of use in crates, barrels, and other packages not usually included in the term "boxes."

At D, Fig. 5, is shown an exterior cleat, of which I may employ eight in the finished box, arranged, as shown, across the ends of the slats and attached to the end parts of the box by nails and also secured to the slats by fastenings *d*, such as nails, independent of the nails which engage said end parts.

I claim—

1. The combined wood and metal fabric or sheet for the construction of boxes and other packages, consisting of thin or veneer wood stock, wires laid across one side only of the

stock and stapled thereto at intervals, and stays or expansion-strips laid parallel to the wires and opposite to the same on the other face of the veneer stock, receiving the staples and serving to keep the wires distended, substantially as specified.

2. The fabric for the construction of boxes and other packages consisting of wooden slats, continuous wires laid across one surface only of the slats and secured thereto by stapling, and stays or expansion-strips for keeping the wires extended, and stays being directly opposite the wires at the other side of the slats and receiving the staples, substantially as specified.

3. The fabric for the construction of boxes and other packages, consisting of thin or veneer stock, continuous wires laid across the outside only of the stock at right angles to the grain thereof and secured thereto at intervals by staples, wooden stay-strips secured to the stock parallel to and directly opposite the wires on the other side of the stock, receiving the staples and serving to keep the wires from bending between the staples, and exterior cleats D, substantially as specified.

4. The box or package in which the four sides are composed of a fabric or sheet consisting of wooden slats, continuous wires laid across one side only of the slats and secured thereto by staples, and stays or expansion-strips for keeping the wires extended, said stays being directly opposite the wires at the other side of the slats and receiving the staples, substantially as specified.

5. The box or package consisting of the four sides and ends, the sides being composed of wooden slats, binding-wires laid across and stapled to the outside faces only of the slats, exterior cleats attached to the ends by nails and also secured to the slats by fastenings independent of said nails, and the stays directly opposite the wires on the other side of the slats and receiving the staples, substantially as specified.

6. The box or package wherein the sides are formed of slats and wires and extension-stays directly opposite the wires on the opposite side of the slats, the sides being at-

tached to the ends by means of nails passed through cleats laid across and attached to the slats by fastenings independent of said nails, the wires, slats and stays being united by through-staples, substantially as specified.

7. The fabric for the construction of boxes and packages, consisting of thin or veneer stock, continuous wires laid across the stock and stapled thereto at intervals, and stiff stays or expansion-strips directly opposite the wires on the other side of the stock and receiving the staples, said stays acting to keep the wires extended and being divided at intervals, substantially as set forth.

8. The fabric for the construction of boxes and packages, consisting of thin or veneer stock, continuous wires [fol. 1581 & 1582] laid across the stock upon one surface thereof, and secured thereto by staples at intervals, and stiff stays or expansion-strips secured to the stock at or near the edges thereof for keeping the wires extended, said stays being directly opposite the wires at the other side of the stock, receiving the staples and divided at intervals for bending at the corners of the box, substantially as specified.

Jason H. Greenstreet.

Witnesses: John E. Davy, J. H. McConnell.

(Here follow side folios 1583-1588.)

[fol. 1589] No. 763,579. Patented June 28, 1904

United States Patent Office

Enos L. Walker, of St. Louis, Missouri

Folding Crate for Berry-Boxes, &c.

Specification Forming Part of Letters Patent No. 763,579, Dated June 28, 1904

Application filed October 20, 1903. Serial No. 177,822. (No model.)

To all whom it may concern:

Be it known that I, Enos L. Walker, a citizen of the United States, residing at St. Louis, State of Missouri,

1583-1584

No. 763,579 PATENTED JUNE 28, 1904.

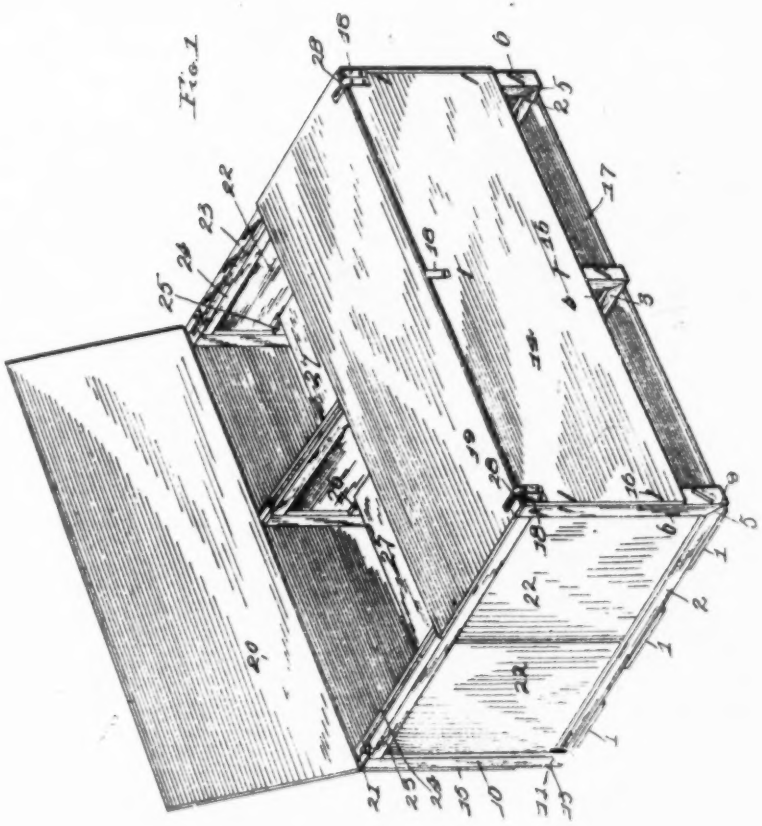
E. L. WALKER.

FOLDING CRATE FOR BERRY BOXES, &c.

APPLICATION FILED OCT. 20, 1903.

NO MODEL. 3 SHEETS—SHEET 1

Fig. 1



ATTEST:—

H. J. Galster

Alfred Bruce

INVENTOR:—

Enos L. Walker

BY Wiglas Hopgood & Calhoun

ATTY'S.

No. 763,579. PATENTED JUNE 28, 1904.

E. L. WALKER.

FOLDING CRATE FOR BERRY BOXES, &c.

APPLICATION FILED OCT. 20, 1903.

NO MODEL. 3 SHEETS—SHEET 2

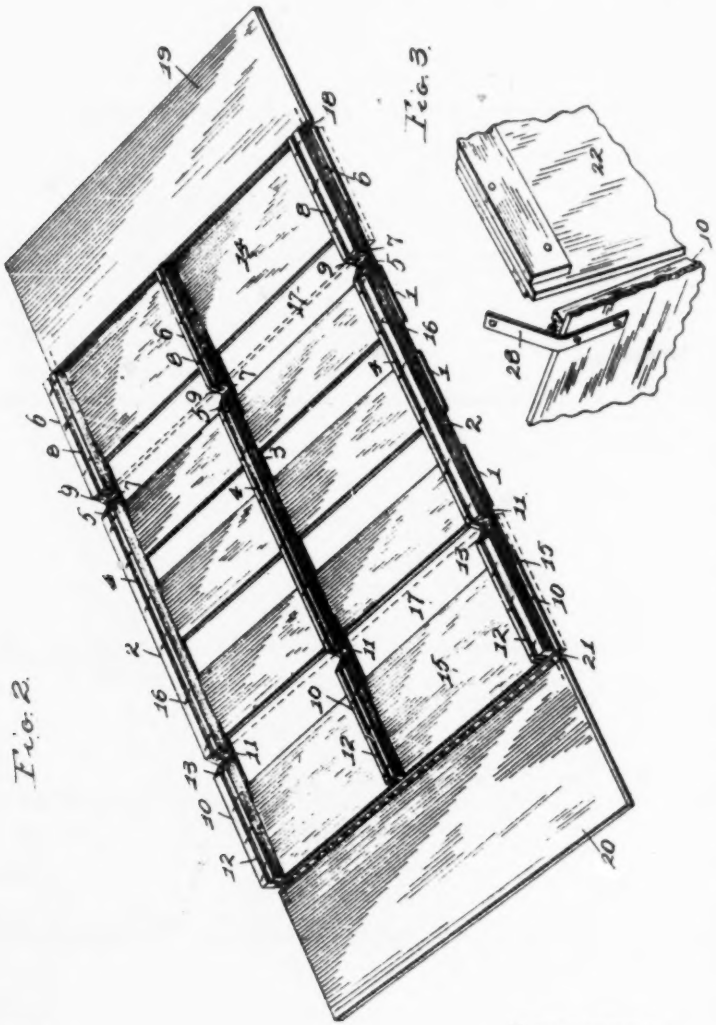


Fig. 2.

Fig. 3.

ATTEST:—

INVENTOR:—

Enos L. Walker

BY Wigton & Longan & Hopkins

ATTY'S

.1587-1588

No. 763,579. PATENTED JUNE 28, 1904

E. L. WALKER.

FOLDING CRATE FOR BERRY BOXES, &c.

APPLICATION FILED OCT. 30, 1903.

NO MODEL. 3 SHEETS—SHEET 3

Fig. 4

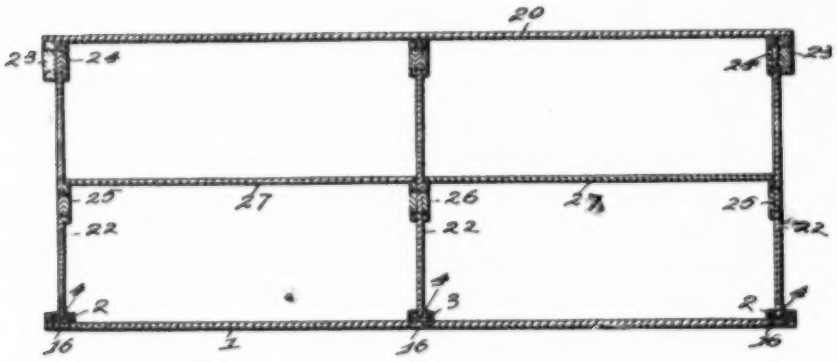
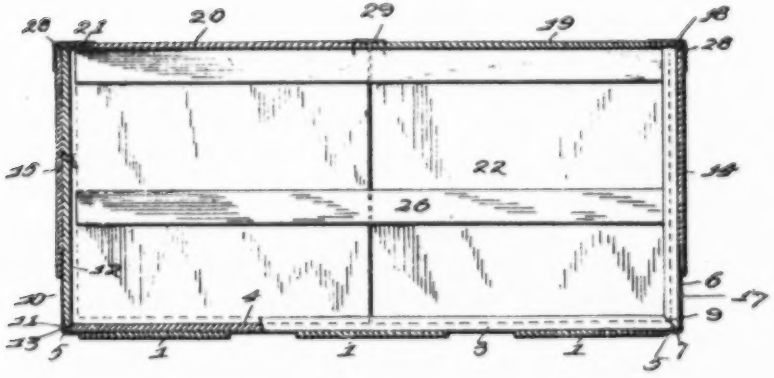


Fig. 5.



ATTEST:—

Alfred A. Ellis

INVENTOR:—

Enos L. Walker

BY Higdon & Longan & Hopkins

ATT'Y.

have invented certain new and useful Improvements in Folding Crates for Berry-Boxes and the Like, of which the following is a specification containing a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention relates to improvements in folding crates for berry-boxes and the like; and it consists of the novel construction, combination, and arrangement of parts hereinafter shown, described, and claimed.

In the drawings, Figure 1 is a perspective view of my improved crate with one of the lid-sections opened and the other closed. Fig. 2 is a perspective view of my crate opened up. Fig. 3 is a detail perspective view, with parts broken away, of one corner of the crate. Fig. 4 is a longitudinal section of my improved crate. Fig. 5 is a transverse section of my improved crate.

The object of my invention is to make a folding crate of wooden veneer, strong and durable, and out of as little material as possible.

Referring to the drawings, 1 indicates the wooden-veneer pieces constituting the bottom of the crate. Secured to the ends of the pieces 1 are wooden strips 2, and secured to the middle of said pieces is a wooden strip 3, the said strips 2 and 3 being of the same construction, and said strips are furthermore provided with the grooves 4. Said strips are also provided with inclined cut-away ends 5, said ends being cut away at an angle of forty-five degrees.

6 indicates strips of material which are secured to the ends of the strips 2 and 3 by means of flexible metallic straps 7. The said strips 6 are provided with grooves 8 and also with inclined or cut-away ends 9, the same being cut away at an angle of forty-five degrees.

When the strips 6 are secured to the strips 2 and 3, as stated, the grooves 8 of the strips 6 and the grooves 4 of the strips 2 and 3 are in perfect alinement. Secured to the other ends of the strips 2 and 3 are strips 10, the said strips 10 being secured to the strips 2 and 3 by means of flexible metallic straps 11. The strips 10 are provided with grooves 12, which lie in alinement with the grooves 4 of strips 2 and 3 and the grooves 8 of strips 6. The strips 10 are also provided with cut-away ends 13, the same being cut away at an angle of forty-five degrees.

Secured to the strips 6 is a wooden-veneer piece 14, which forms one side of the crate, and secured to the strips 10 is a wooden-veneer piece 15, which forms the other side of the crate. The pieces 14 and 15 and the piece 1 are respectively secured to the strips 6, 2, 3, and 10 by means of staples 16. Said staples 16 are driven through the pieces 14, 1, and 15 and through the strips 6, 2, 3, and 10, the prongs of said staples straddling the grooves 8, 4, and 12 and are clenched on the inside. The object of this construction is that the prongs of the staples strengthen the strips 6, 2, 3, and 10 and prevent the same from splitting. As the grooves formed in said pieces weaken the same, the prongs of the staples passing through the pieces to the sides of the grooves will necessarily tend to strengthen the same.

When the wooden-veneer pieces 14 and 15 have been secured to the strips 6 and 10, openings 17 are formed, which permit of ventilation to the interior of the crate. The pieces 1 are also spaced apart to save material and permit of ventilation to the inside of the crate. Secured to the strips 6 by means of flexible metallic straps 18 is a piece 19, which forms a portion of the lid of the crate, and secured to the strips 10 is a wooden-veneer piece 20, which forms the other portion of the lid of the crate. The piece 20 is secured to the strips 10 by means of flexible metallic straps 21.

I have heretofore described the bottom, sides, and lid of the crate. I will now proceed to describe the construction of the ends and how the ends are applied to the crate, it being noted that both ends are of the same construction and are made out of two pieces of wooden veneer 22. Located along the top edge of said pieces 22 and secured thereto is [fol. 1590] an outside reinforcing-strip 23 and an inside reinforcing-strip 24. The said reinforcing-strips 23 and 24 are of less length than the combined width of the pieces 22. In other words, the pieces 22 project beyond the ends of the reinforcing-strips 23 and 24 a sufficient distance to take up the depth of the grooves formed in the strips 6 and 10. Secured on the inside of the pieces 22, which constitute the crate, are strips 25. The center partition of the crate is constructed similar to the ends of the crate—that is, with reinforcing-strips at the top edge and having located on each side thereof a central strip 26, the strips 25 of the ends

of the crate and the strips 26 of the central partition of the crate answering as a support for the partition-shelves 27.

When the ends of the crate and the central partition have been constructed as described and when it is desired to assemble the crate, the lower edges of said ends and central partition and the sides thereof are inserted in the grooves of the strips 6, 2, 3, and 10 and are held in said position by by means of the flexible metallic straps 28, one end of said straps being secured to the sides of the crate and the other end being bent over and tacked to the ends and central partition of the crate. (See Figs. 1 and 3 for illustration.)

The pieces 19 and 20, constituting the lid of the crate, are held closed by means of the staples 29, which are driven through said pieces and into the ends and the central partition of the crate.

When the crate is shipped knocked down, the pieces 19 and 20 are folded under the pieces 14 and 15, as illustrated in dotted lines in Fig. 2, and as many of said crates may be piled upon each other as desired, the ends and central partitions being nested separately, if desired. The crate is so constructed that when shipped in its knockdown condition it carries with it all the parts necessary to assemble it, and all that is necessary to be done is to insert the ends and central partition, as heretofore described, and secure the free ends of the straps 28 to said ends and central partition when the crate is set up.

It will be seen from the foregoing description that I have constructed a crate which is made principally of wooden veneer and which is very light and compact, easily knocked down and assembled, and which is especially designed for wooden-veneer berry-boxes.

Having fully described my invention, what I claim is—

As an article of manufacture, a folding crate for berry-boxes and the like, comprising the wooden-veneer pieces 1; the grooved strips 2 secured to the ends of the pieces 1; the grooved strip 3 secured to the middle of the pieces 1; the metal straps 7 secured to the ends of the strips 2 and 3; the metal straps 11 secured to the opposite ends of said strips; the grooved strips 6 secured to the straps 7; the grooved strips 10 secured to the straps 11; the wooden-veneer piece 14 secured to the strips 6; the wooden-veneer piece 15 secured to the strips 10; all of said veneer pieces

being secured by means of staples 16; the prongs of said staples straddling the grooves in said strips; the straps 18 secured to the strips 6; the lid 19 secured to the straps 18; the straps 21 secured to the strips 10; the lid 20 secured to the straps 21; the veneer pieces 22; the reinforcing-strips 23 and 24 applied to said veneer pieces; the strips 25 secured to the insides of the veneer pieces 22; the center partition having the strips 26 on each side; the shelves 27 resting upon the strips 25 and 26; and the strap 28 securing the ends and center in position; substantially as specified.

In testimony whereof I have signed my name to this specification in presence of two subscribing witnesses.

Enos L. Walker.

Witnesses: M. G. Irion, John C. Higdon.

(Here follow side folois 1591-1596.)

[fol. 1597] No. 767,613. Patented August 16, 1904

United States Patent Office

Enos L. Walker, of St. Louis, Missouri

Knockdown Fruit-package

Specification Forming Part of Letters Patent No. 767,613, Dated August 16, 1904

Application filed November 18, 1903. Serial No. 181,747. (No model.)

To all whom it may concern:

Be it known that I, Enos L. Walker, a citizen of the United States of America, and a resident of St. Louis, Missouri, have invented certain new and useful Improvements in Knockdown Fruit-Packages, of which the following is a specification.

My invention contemplates an improved form of knockdown fruit-package for shipping berries or other kinds of

1591-1592

No. 767,613. PATENTED AUG. 16, 1904.

E. L. WALKER.

KNOCKDOWN FRUIT PACKAGE.

APPLICATION FILED NOV. 18, 1903.

NO MODEL 3 SHEETS—SHEET 1

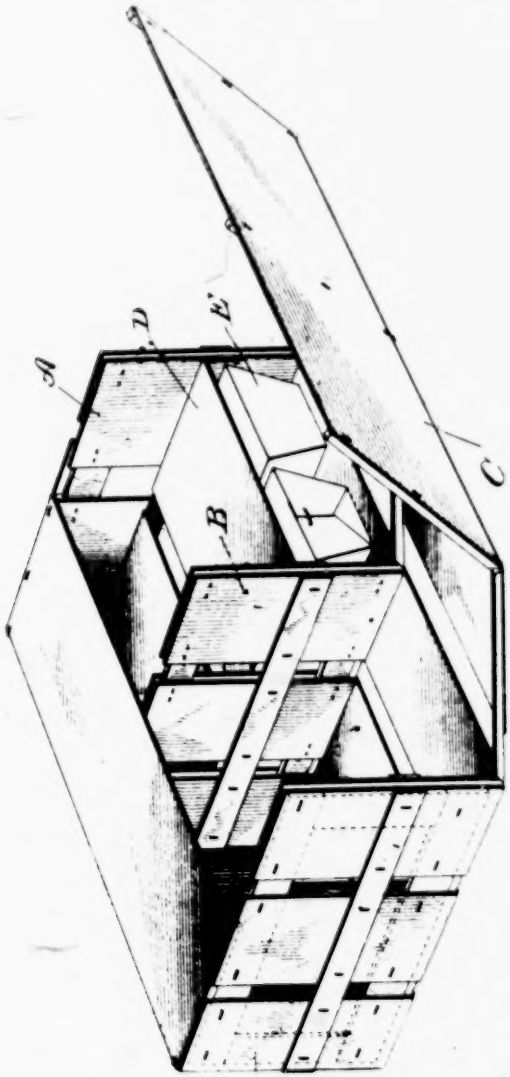


Fig. 1.

Witnesses:
Robert F. Walker
M. L. McCabe

Inventor:
Enos L. Walker
By Pierce & Durand
Attys

No. 767,613. PATENTED AUG. 16, 1904

E. L. WALKER.

KNOCKDOWN FRUIT PACKAGE.

APPLICATION FILED NOV. 18, 1903

NO MODEL. 3 SHEETS—SHEET 2

Fig. 2.

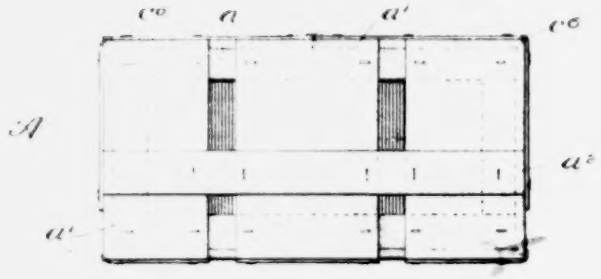
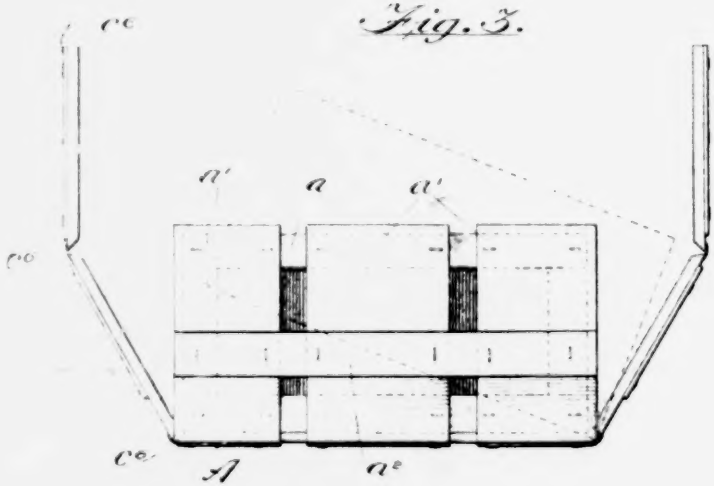


Fig. 3.



Witnesses
Robert F. Wells
W. L. McGuire

Inventor
Elwood Walker
By Burleigh & Durand
Attys

No. 767,613 PATENTED AUG. 16, 1904.

E. L. WALKER.

KNOCKDOWN FRUIT PACKAGE.

APPLICATION FILED NOV. 16, 1903

NO MODEL. 3 SHEETS—SHEET 2

Fig. 4.

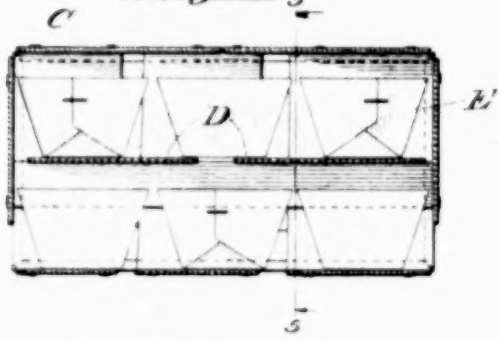


Fig. 5.

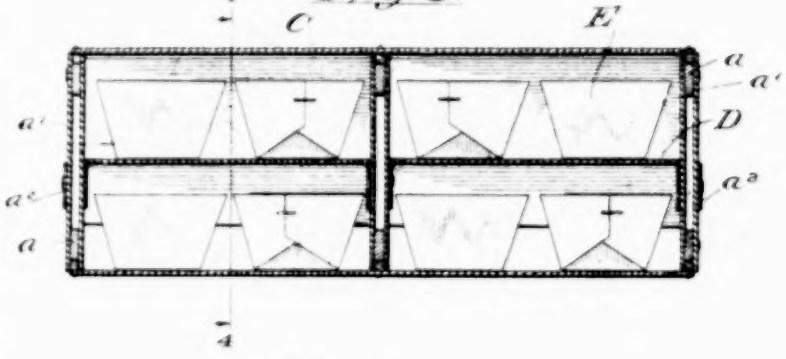
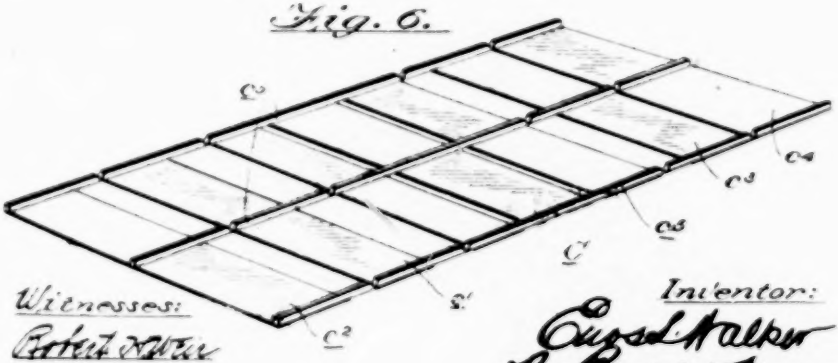


Fig. 6.



Witnesses:

Robert Watson

M. J. McGinn

Inventor:

Edgar L. Walker

By Burton & Burton

Attys.

fruit, and involves, preferably, a knockdown crate composed of end and intermediate walls having grooved or channeled edges, both at top and bottom and at the sides, and a flexible member or member composed of hinge-connected sections adapted to be folded about or made to conform to the rectangular outline of said walls and provided with tongues or projections adapted to engage the grooves in the edges of said walls.

Generally stated, the object of my invention is to provide a simple and improved form of knockdown fruit-package, to provide a construction which will tend to reduce the cost of manufacture, to provide a construction which will combine simplicity and lightness with strength and rigidity, to provide an improved form of knockdown crate which can be sold and satisfactorily shipped in a dismembered or knockdown condition, and also to provide certain details and features of improvement tending to increase the general efficiency and serviceability of a knockdown crate or fruit-package of this particular character.

The nature and advantages of my invention will, however, hereinafter more fully appear.

In the accompanying drawings, Figure 1 is perspective of a knockdown fruit-package involving the features of my invention, the crate being shown partially open and one compartment of the crate being shown partially filled with berry-boxes. Fig. 2 is an end view of the said package, showing the crate in a closed condition. Fig. 3 is a view similar to Fig. 2, but showing the crate open above and at each side. Fig. 4 is a cross-section of the crate in a closed condition. Fig. 5 is a longitudinal section showing the crate closed. Fig. 6 is a perspective of the flat and flexible member or member composed of swingingly-connected sections, which constitutes the covering or enveloping medium of the crate and which when applied provides the top and bottom and sides of the crate.

As thus illustrated, my improved fruit-package comprises end and intermediate walls A and B, the inclosing or enveloping member C, and the thin boards D, which latter are employed as the upper floor of the crate. The said end and intermediate walls are each of a built-up character—that is to say, each wall consists of a plurality of layers or strips secured flatwise together and preferably

with the grain of one layer running at right angles to the grain of the other layer. For example, the wall A, as shown in Figs. 1, 2, and 3, comprises the rectangular frame a, the thin strips or boards a', applied crosswise and to each side of said frame, the grain of the boards a' extending vertically, and these boards being of a length and width to extend slightly beyond the edges of the said frame. In this way each wall is provided with grooved or channeled edges both at top and bottom and at the sides, said grooves being of some depth and corresponding in width to the thickness of the frame a. With this construction the walls combine lightness with strength and rigidity, and furthermore, they are not liable to warp or shrink out of shape. If desired, each wall can be provided on each surface with a strengthening or reinforcing strip a^2, and these strips, which occur on the inner surface of the end walls and on both surfaces of the intermediate wall, may serve as supporting-ledges for the boards D.

The inclosing or enveloping member C' comprises five swingingly or hinge connected sections c, c', c^2, c^3, and c^4. It will be observed that each section comprises one or more thin strips of wood or other suitable material secured to the end and intermediate narrow strips. These end and intermediate strips have their ends preferably beveled, so as to permit the sections to swing relatively to each other when they are all connected up in the manner shown in Fig. 6. Thus constructed, the inclosing or enveloping mem- [fol. 1598] ber C' is provided with a plurality of tongues or ridges c^5, these tongues or ridges being divided up into hinge-connected sections corresponding in length to the different sections of which the member C' is composed. The flat strips and the narrow strips of which the member C' is composed can be secured together in any suitable manner; but as a matter of further and special improvement they are secured together by staples, and the junctions between the sections are provided with staples c^6, these staples c^6 spanning the joints, and thus serving as hinges. In other words, the staples c^6 are sufficiently flexible to permit the sections of the member C' to be swung relatively to each other quite a number of times and as much as is necessary before breaking. It will be seen that it is the beveled ends of the sections of the tongues c^5 which per-

mit the member C to be applied and folded about the intermediate and end walls A and B. It is also preferable to employ staples for securing together the different pieces or strips of which the end and intermediate walls A and B are composed.

When applied, the inclosing or enveloping member C folds up in such manner as to fit the top and bottom and sides of the end and intermediate walls A and B, as shown in the drawings, the different sections of the tongues c^3 fitting and engaging in the grooves in the top and bottom and side edges of the said walls. These tongues can fit within the grooves in such manner as to render it not absolutely necessary to employ nails or any other fastening devices for securing the cover portions or sections c^2 and c^4 in place upon the top of the crate. It is obvious, however, that nails or other fastening devices can be inserted through the cover portions c^2 and c^4 and into the top edges of the end and intermediate walls, so as to securely close the crate, if such is desired.

Berry-boxes E of any suitable form or construction can be placed within the compartments provided in the crate, the boxes being arranged in upper and lower tiers, the lower tiers of the two compartments resting on the section c of the enveloping member and the boxes of the upper tiers resting on the upper floor-pieces D, as shown in Figs. 1, 4, and 5.

The knockdown crate thus constructed is simple, comparatively cheap to manufacture, and is comparatively light and strong. The construction tends to prevent the different parts from warping or shrinking out of shape and renders the completed article very satisfactory in use. Comparatively few staples or other fastening devices are necessary for securing the different parts together, and, as previously explained, only one staple is necessary at each joint or junction between any two sections of the tongues c^3. The crate can be sold and satisfactorily shipped in a dismantled or knockdown condition.

In my improved construction it will be seen that the tongues c^3 are secured to the inner surface of the enveloping member C and that consequently these tongues are adapted to engage in the grooves formed between the top and bottom and side edges of the outer layers of strips of

which the transverse walls A and B are composed. In other words, these transverse end and intermediate partitions or walls are each composed of outside and intermediate strips or layers, the intermediate strips or layers being of sufficient thickness and positioned far enough back from the edges of the outside strips or layers to provide each wall as a whole with top and bottom and side grooves adapted to receive the tongues provided on the inner surface of the flexible enveloping member.

What I claim as my invention is—

1. A knockdown fruit-package comprising end and intermediate walls having their top and bottom and side edges provided with grooves, and an inclosing or enveloping member, said inclosing or enveloping member being composed of swingly-connected sections provided on the inside with tongues adapted to engage the said grooves.

2. A knockdown fruit-package comprising end and intermediate walls having their top and bottom and side edges provided with grooves, each wall consisting of a rectangular frame having flat strips secured to its sides, and an inclosing or enveloping member composed of a plurality of swingingly-connected sections provided on the inside with projections adapted to engage said grooves.

3. A knockdown fruit-package comprising a plurality of vertical walls having their top and bottom and side edges provided with grooves, and an inclosing or enveloping member provided on the inside with tongues adapted to engage said grooves.

4. A knockdown fruit-package comprising a plurality of walls having their top and bottom and side edges provided with grooves, and an inclosing or enveloping member composed of swingingly-connected sections provided with tongues adapted to engage said grooves, each joint or junction between two tongue-sections being provided with a single staple adapted to act as a hinge.

5. A knockdown receptacle comprising a plurality of walls having their top and bottom and side edges provided with grooves, and an inclosing or enveloping member provided on the inside with tongues adapted to engage said grooves.

6. A knockdown fruit-package comprising a plurality of walls having their top and bottom and side edges provided with grooves, each wall consisting of outer and intermediate strips of wood secured together by staples, and an inclosing or enveloping member composed of sections provided with tongues adapted to engage said grooves, the [fols. 1599 & 1600] said sections being swingingly connected together by staples, a single staple being applied to each joint between two tongue-sections.

7. A knockdown fruit-package comprising removable vertical walls, and a flexible enveloping member, said vertical walls having edges provided with grooves, and said enveloping member consisting of parallel strips connected together by tongues adapted to engage said grooves, and said tongues being made in sections having their ends connected by staples serving as hinges.

8. A knockdown fruit-package comprising a plurality of rectangular vertical walls, and a flexible enveloping member adapted to be folded about the said vertical walls to provide the top and bottom and side walls of said package, the said vertical walls having edges provided with suitable grooves, and said enveloping member being provided on its inner surface with tongues adapted to engage said grooves.

9. A knockdown fruit-package comprising removable vertical walls, and a flexible enveloping member, said vertical walls having edges provided with grooves, and said enveloping member consisting of parallel strips connected together by tongues extending at right angles to said strips and adapted to engage said grooves.

10. A knockdown fruit-package comprising a plurality of detachable and rectangularly-shaped vertical walls, each vertical wall consisting of outside and intermediate strips of wood, the intermediate strips being arranged at right angles to the outside strips, and a flexible enveloping member adapted to be folded about the said vertical walls to provide top and bottom and side walls for the package, said flexible enveloping member being provided with narrow strips adapted to engage between the top and bottom and side edges of the outside strips of said vertical walls.

Signed by me at Chicago, Cook county, Illinois, this 21 day of November, 1903.

Enos L. Walker.

Witnesses: S. B. Chabowski, Wm. A. Harders.

(Here follow side folios 1601 and 1602.)

[fols. 1603 & 1604] No. 768,123. Patented August 23, 1904

United States Patent Office

Philip J. Healy, of East St. Louis, Illinois

Folding Box or Crate

Specification Forming Part of Letters Patent No. 768,123, Dated August 23, 1904

Application filed April 26, 1904. Serial No. 205,042. (No model.)

To all whom it may concern:

Be it known that I, Philip J. Healy, a citizen of the United States, residing at East St. Louis, St. Clair county, Illinois, have invented certain new and useful Improvements in Folding Boxes or Crates, of which the following is a specification.

My invention relates to that class of boxes or crates in which the sides are flexibly connected by means of straps, so as to be compactly folded when not in use.

The object of the invention is to provide a folding box or crate with flexible straps to which all four sides are connected at or near their ends, said straps having integral folded loops at one end, through which their other ends are adapted to be passed and then bent over to secure the box in its extended or operative position. Furthermore, the inner faces of the end portion of the sides are provided with cleats to hold the separate and independent ends in place. This object I accomplish by the construction shown in the accompanying drawings in which

No. 768,123 PATENTED AUG. 23, 1904

P. J. HEALY.

FOLDING BOX OR CRATE.

APPLICATION FILED APR. 26, 1904.

NO MODEL.

Fig. 1.

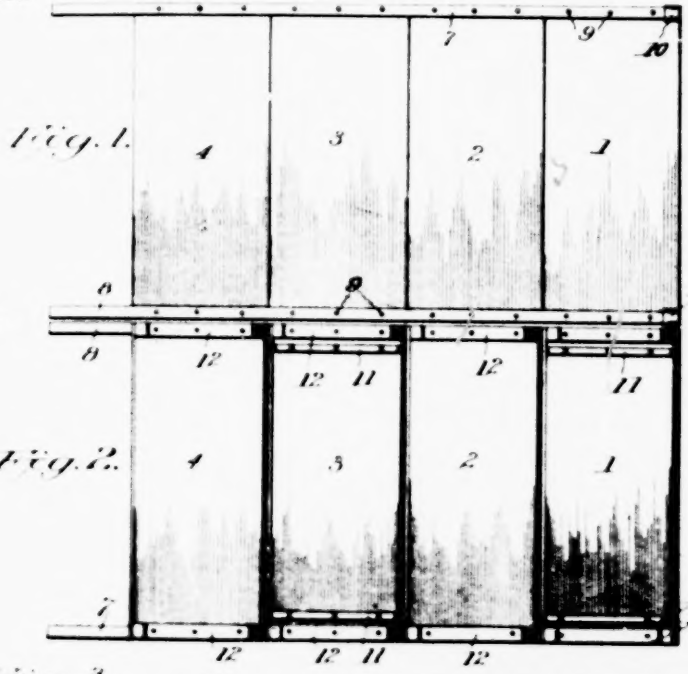


Fig. 2.

Fig. 3.

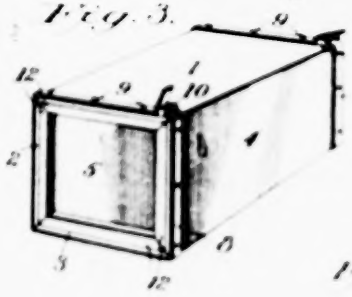


Fig. 4.

Fig. 6.

Fig. 5.

WITNESSES:

E. M. Wathen

J. M. Copeland

INVENTOR

Philip J. Healy

BY

Geo. H. Graves

ATTORNEY

Figure 1 is a plan from the exterior of connected sides of the box or crate ready for folding. Fig. 2 is a like view of the interior. Fig. 3 is a perspective of the box or crate ready for use. Fig. 4 shows the end pieces. Fig. 5 is a detail view showing the formation of the strap-loop. Fig. 6 is a horizontal section through Fig. 3.

The box or crate is formed of the four sides 1 2 3 4, flexibly connected on their outer sides at or near their ends by the metallic straps 7 8, which are secured thereto by nails, rivets, prongs, or screws, as shown at 9, the straps at one end projecting beyond the side 4 and at their other ends provided with integral loops 10. These loops are formed by first bending the strap over, as at 10^a, and then folding the portion beyond the bend around the strap several times to form the loop. When the box is set up, the free ends of the straps are passed through the loops 10 and then bent back, as shown in Fig. 3.

In order to secure the ends 5 6 in place, I provide the inner faces of all the sides at their ends with cleats 12, those at each end being in longitudinal alinement, but spaced apart to allow the sides to be properly set up, and the sides 1 and 3 are further provided with inner inderent cleats 11 11, parallel with the cleats 12, so as to form dovetail grooves, in which the ends 5 6 are held against movement, the ends being provided at two edges with dovetails 5^a 6^a to interlock with the inderent or dovetail grooves between cleats 11 and 12.

To set up the box or crate, it is simply necessary to raise the sides 1 and 3 perpendicular to side 2 and then slip the dovetail edges of ends 5 6 down into the dovetail grooves formed by the cleats 11 12, (see Fig. 4,) when the interlocking of these dovetails will hold the box or crate in position to have its top 1 folded over and secured by passing the strap ends through loops 10 and bending them back upon themselves.

The box or crate may be used without the ends when lard and paint in cans is to be shipped, as the cleats will prevent the cans from slipping out.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is

1. A folding box or crate comprising a series of sides or members, parallel flexible straps connecting said sides

or members; one end of each strap being bent transversely and folded around to form box-loops of a width to allow the other ends of the straps to be passed through.

2. A folding box or crate comprising four sides or members, pairs of parallel cleats secured to the inner faces of two of said sides at or near both ends thereof and undercut to form dovetail grooves, end pieces having dovetail edges to fit said dovetail grooves and flexible straps secured to the said sides and formed at one end with box-loops of a width to allow their other ends to be passed through.

3. In a folding box or crate a flexible strap for connecting the members, provided at one end with a box-loop, formed of a series of transverse folds and of a width to allow the other end to pass through.

In testimony whereof I affix my signature in presence of two witnesses.

Philip J. Healy.

Witnesses: Geo. D. Pfeiffenberger, Samuel W. Batzer.

(Here follow side folios 1605 1608.)

[fols. 1609 & 1610] United States Patent Office

Richard G. Inwood and Perry C. Lavenberg, of South Bend, Indiana, Assignors to the National Wire Bound Box Company, of South Bend, Indiana, a Corporation of Indiana.

Box

No. 799,854. Specification of Letters Patent. Patented Sept. 19, 1905

Application filed October 17, 1904. Serial No. 228,765

To all whom it may concern:

Be it known that we, Richard G. Inwood and Perry C. Lavenberg, citizens of the United States, residing at South Bend, in the county of St. Joseph and State of Indiana,

1605-1606

No. 799,854. PATENTED SEPT. 19, 1905.

R. G. INWOOD & P. C. LAVENBERG.

BOX.

APPLICATION FILED OCT. 17, 1904

2 SHEETS—SHEET 1.

Fig 1

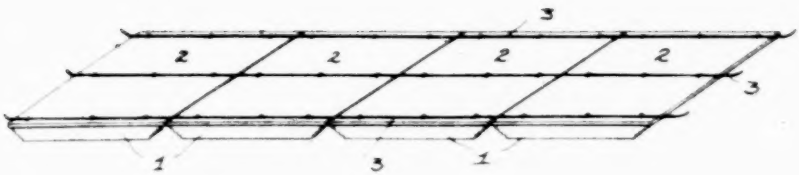
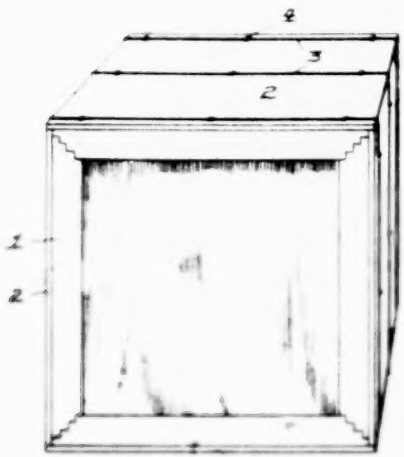


Fig 2



Witnesses
George Attach
Jos. P. Wernimont

Richard G. Inwood
P. C. Lavenberg
Inventors

No. 799,854. PATENTED SEPT. 19, 1905.

R. G. INWOOD & P. C. LAVENBERG.

FOX.

APPLICATION FILED OCT. 17, 1904.

2 SHEETS-SHEET 2.

Fig 3

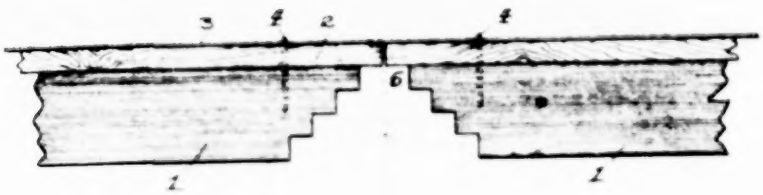


Fig 4

Witnesses
Geo. Otterbach
Jos. A. Wenninger

Richard G. Inwood
P. C. Lavenberg
Inventors

have invented new and useful Improvements in Boxes, of which the following is a specification.

Our invention relates to certain improvements in wire-bound boxes, especially of that class in which the blanks constituting the four sides of the box are assembled and secured in relative position to each other prior to folding by reinforcing-wires, and has for its object the assembling and fastening together such parts constituting the completed blank, so that the same when folded will produce overlapping edges of the side sheets or boards, the advantages of which will be hereinafter pointed out.

Referring to the drawings, Figure 1 shows a complete box-blank which forms the four sides of a box when folded. Fig. 2 is a perspective view of the blank when folded, showing the sides thereof overlapping and box end in place. Fig. 3 shows two enlarged sections of the blanks, the full lines before folding and the dotted lines a section folded at right angles to the other in making a joint, the full lines also showing the spacing of the cleats and sheets with relation to each other. Fig. 4 shows an enlarged fragmental view of two sections and the radius of movement relative to each other at different stages in the action of folding.

In the drawings, 1 represents the cleats, which are step-mitered at their ends.

2 represents the box sides or sheets, which are disposed upon the cleats, and 3 represents reinforcing-wires which are positioned coincident with the cleats and staples 4, driven straddling of said wires through the sheets into the cleats, the reinforcing-wires thereby also serving to hinge the four sections comprising the completed blank together.

The ends of the cleats 1 are spaced a distance apart, measured from the adjoining edges of the sheets, equal to the thickness of such sheets, as at 5, so that when the blank is folded to form the four sides of a box the sheets will overlap and form a square-cornered box, as shown in Fig. 2.

It may appear from the drawings that difficulty would be experienced in folding the sections, owing to the edges of the sheets abutting and the same being held in that relative position and against movement away from each other by the reinforcing-wires. It is found in practice, however, the sheets being of soft-wood veneering, that in folding over one section on the other the reinforcing-wire will cut into

the sharp edges of the sheets, as shown at 6 in Fig. 4, and the end of one sheet will crush the inner edge of the adjoining sheet sufficiently, as at 7, Fig. 4, so as to allow same to pass each other and fold over, so as to form overlapping edges or joints.

The present method of manufacturing wire-bound boxes is to form the blank of a single sheet stitched or stapled to single-piece cleats for each end of the box, the cleats being step-mitered and the sheets scored or grooved on the under side, so as to form four sections after the cleats, sheets, and reinforcing-wires have been stapled together. This box-blank when folded forms a rounding edge. The veneer sheets, if not thoroughly seasoned so as to have pliability, begin to check as the lumber seasons. As the grain of the wood may be diagonal to the edge of the box, the check will follow the grain, thus rendering the box unsightly, besides a possible opening of a size so as to preclude its use for goods requiring a tight-jointed box.

We claim as our invention, and desire to secure by Letters Patent

A wire-bound foldable box-blank, comprising a plurality of straight-edged sheets, wires secured to and connecting said sheets, and step-mitered cleats secured to said sheets to terminate short of edges of the latter a distance equal to the thickness of a sheet, whereby when folded at a right angle the end of one sheet overlaps the end of an adjacent sheet.

In testimony whereof we affix our signatures in presence of two subscribing witnesses.

Richard G. Inwood, Perry C. Lavenberg.

Witnesses: George Oltsch, Jos. A. Werninski.

(Here follow side folios 1611-1618)

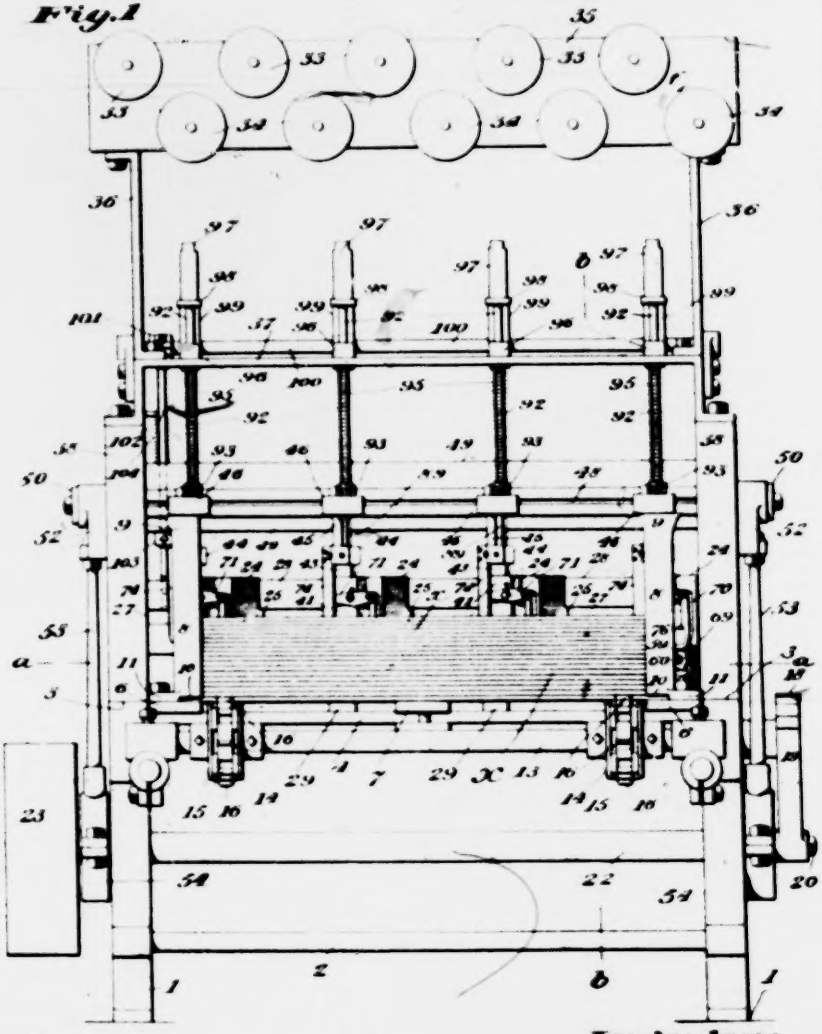
W. LIPPS & I. SPRINGER.

BOX MAKING MACHINE.

APPLICATION FILED [illegible] 1902

4 SHEETS SHEET 1

Fig. 1



Witnesses

R. F. Lorne

Stuart Hoskin

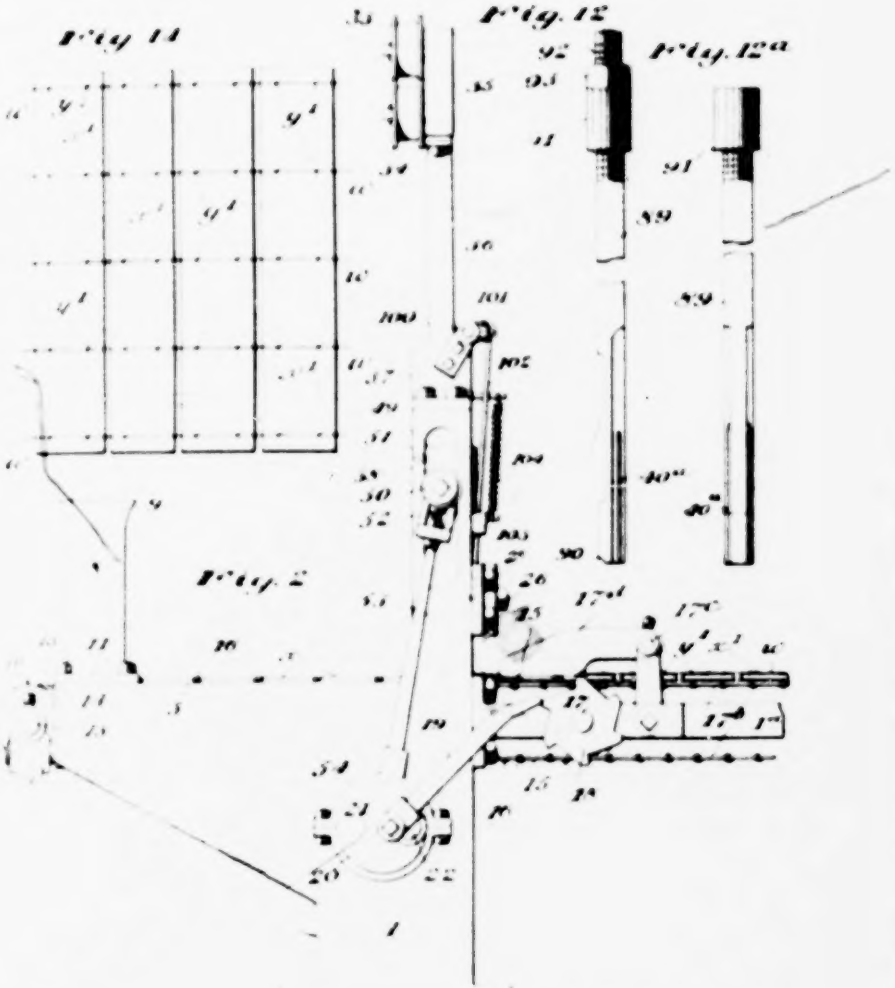
Inventors

William Lipps and
Isaac Springer,
by John Thiel Jones,
their Attorney.

No. 801,998. PATENTED OCT. 17, 1905.

W. LIPPS & T. SEININGER.

BOX MAKING MACHINE.

APPLICATION FILED MARCH 10, 1902. 4 SHEETS-SHEET 1.

Witnesses

Inventors

No. 801,998. PATENTED OCT. 17, 1905.

W. LIPPS & I. SPRINGER.

BOX MAKING MACHINE.

APPLICATION FILED JUNE 30, 1902.

4 SHEETS SHEET 3.

Fig. 3

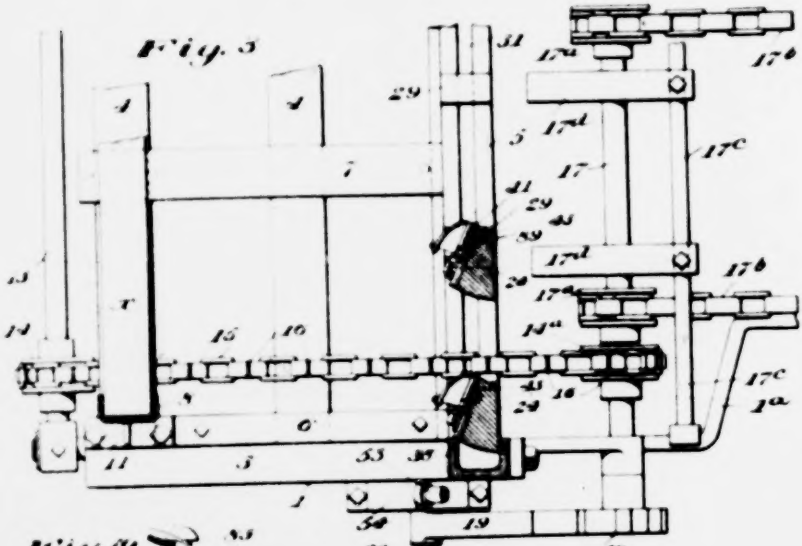


Fig. 10

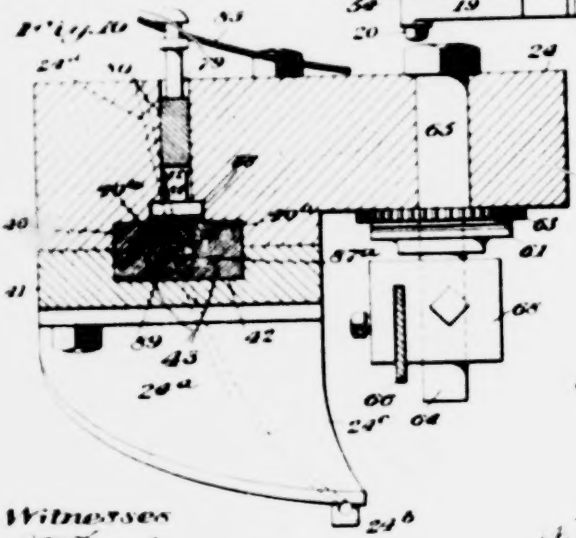


Fig. 13

Witnesses
H. Howe
Stuart Harper

Inventors
William Lipps and
Isaac Springer,
by John Elias Jones,
their attorney.

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W. LIPPS & I. SPRINGER.

BOX MAKING MACHINE.

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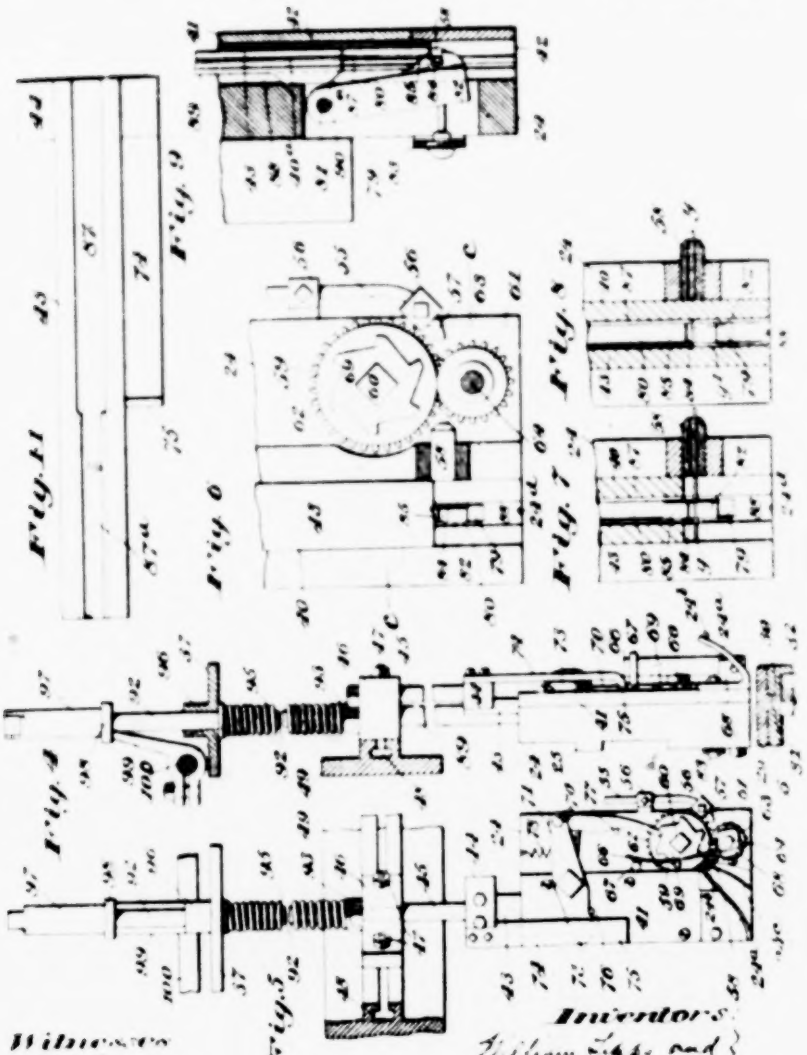

Witnesses
J. E. Kerr
Chas. Harper

Inventors
William Lipps and
Isaac Springer,
by John Elbert Jones
their Attorney

[Col. 1619] United States Patent Office

William Lipps and Isaac Springer, of Ridgedale, Tennessee, Assignors to Consignees Favorite Box Company, of Chattanooga, Tennessee, a Corporation of Tennessee

Box-making Machine

No. 801,208. Specifications of Letters Patent. Patented Oct. 17, 1905

Application Filed June 30, 1902. Serial No. 113,854

To all whom it may concern:

Be it known that we, William Lipps and Isaac Springer, citizens of the United States of America, and residents of Ridgedale, in the county of Hamilton and State of Tennessee, have invented certain new and useful Improvements in Box-Making Machines, of which the following is a specification.

This invention relates to certain improvements in machines such as are adapted for use in driving staples and similar fastening devices, and more especially that class of such machines wherein are combined with the staple-driving means devices for feeding the materials in connection with which the staples or other fastening devices are employed to such driving means, together with mechanism for forming or producing the staples from a wire or strip of metal continuously fed to the machine; and the object of the invention is to provide a machine of this character of a simple and inexpensive nature and of a compact, strong, and durable construction having improved means for driving the staples and capable of operation at a considerable speed without danger of breakage or of impairment of the work, so that an increased output of work is afforded.

The invention consists in certain novel features of the construction and combinations and arrangements of the several parts of the improved staple-driving machine whereby certain important advantages are attained and the device is made simpler, cheaper, and is otherwise better

adapted and made more convenient for use, all as will be hereinafter fully set forth.

The novel features of the invention will be carefully defined in the claims.

In the accompanying drawings, which serve to illustrate the invention, Figure 1 is a front elevation showing the improved machine, and Fig. 2 is a side elevation thereof. Fig. 3 is a partial section taken horizontally through the improved machine in the plane indicated by the line 3—3 in Fig. 1 and showing certain features to be hereinafter set forth. Fig. 4 is a partial section taken vertically through the machine in the plane indicated by the line 4—4 in Fig. 1 and showing certain features to be hereinafter referred to. Fig. 5 is a front elevation, drawn to an enlarged scale, and showing, detached, certain features of the staple forming and setting or driving devices to be hereinafter referred to. Fig. 6 is an enlarged partial view showing certain features of the mechanism for feeding the wire for forming the staples. Fig. 7 is a partial sectional view showing certain features of the mechanism for forming the staples, the parts being shown in an initial position. Fig. 8 is a view similar to Fig. 7, but showing the parts moved to another position. Fig. 9 is an enlarged sectional view showing features of the mechanism for forming and driving or setting the staples. Fig. 10 is a horizontal section, drawn to a larger scale and taken in the plane indicated by the line 10—10 in Fig. 6 and showing certain features of the wire feeding and staple forming and driving or setting mechanisms. Fig. 11 is a detached detail view showing the rear face of the die or former for forming the staples. Fig. 12 is a detached detail side view showing the hammer or driver for setting or driving the staples, together with the chuck by which said hammer or driver is carried. Fig. 12' is a view similar to Fig. 12, but showing the hammer or driver in front elevation. Fig. 13 is a detached detail view showing the eccentric pin or stud, whereon is carried the lower pressure-roller of the wire-feeding mechanism. Fig. 14 is a view showing a section or fragment of the finished product of the improved machine.

As shown in the views, the improved machine is formed with a frame comprising side pieces 1 1, braced at their

lower parts by suitable girths or cross-bars, as shown at 2, and having near their upper parts forwardly-extended portions 3 3, between which are extended cross-bars 4 4, in a manner to produce a flattened table at the forward or feeding end of the machine. The bars 4 are spaced apart, and behind them is arranged a bar 5, also extended across the frame parallel to the bars 4 4. At the sides of the table thus produced at the feeding end of the machine are extended side guides 6 6, parallel with the side pieces 1 of the frame and adjustable toward and away from each other. These guides 6 6 are designed to prevent endwise movement of the strips of veneer being fed into the machine. Central between the guides 6 6 is a support 7, parallel with said guides and designed to support the veneer strips at their central parts while being fed into the machine.

[fol. 1620] Supported upon the forward ends of the side guides 6 6 are end guides 8 8 for the ends of the veneer strips to be fed into the machine, these guides 8 being, as shown in Fig. 3, chambered or recessed on their adjacent sides to receive the ends of the veneer strips *x* which rest in a pile or stack between the said end guides. The upper ends of the guides are made enlarged, as shown at 9, to facilitate the introduction of the strips *x* therein, and at their lower ends the front and back walls of the said end guides 8 are cut out, as shown at 10, to permit the withdrawal of the veneer strips from the under side of the stack or pile successively and one at a time, as will be hereinafter explained. The end guides 8 have integral feet 11, which are held by screws or otherwise upon the guides 6.

For successively withdrawing single or individual strips *x* from the under side of the rack or pile held in the end guides 8 feeding mechanism comprising chain or link belts 15 15 are provided, there being preferably one of said chain or link belts adjacent to each side of the table of the machine and each chain or link belt having its alternate links formed with projecting portions 16, adapted as the chains pass in their movement beneath the pile or stack of strips *x* to engage against the forward edges of the lowermost strips in the stack or pile and move the same rearwardly from beneath the overlying strips of the stack or pile, the dimensions of the cut-out portions 10 in the end guides 8 being

such as to permit the abstraction in this manner of but a single strip *x* at a time by each two allied projections or teeth 16 in two link or chain belts 15 15. In this way the veneer strips *x* are segregated from the stack or pile and are fed successively along the table of the machine-frame, being supported upon the chains and parts 6 and 7 and held against endwise movement by the side guides 6 6. The forward bights of the link or chain belts 15 are passed about wheels 14, held adjustably upon a cross-shaft 13, extended along the front of the frame, and the rear bights of said belts are held upon chain-wheels 14^a upon another cross-shaft 17, extended between brackets at the rear of the side pieces 1 1 of the frame, one end of said shaft 17 being provided with a ratchet-wheel 18, engaged by a dog or pawl 19, carried upon an eccentric stud or crank-pin 20 on one end of the machine-shaft 22. The machine-shaft 22 is journaled transversely of the lower part of the frame and carries at the side of said frame opposite to the ratchet-wheel 18 a pulley 23, adapted to receive a belt or band, from which the machine may be driven from any suitable source of power.

By means of the feeding mechanism above described the veneer strips or slats *x* are carried through the machine and beneath staple forming and driving or setting devices, to be hereinafter described, and by means of such staple forming and setting devices the said strips or slats are connected in a series by means of a plurality of wires held to the slats or strips by means of the staples. The staple forming and setting devices are arranged at the rear end of the table of the machine-frame, and behind said table the frame has an extension 1^a of any desired length, (only a portion of said extension being shown on the drawings,) Above the extension 1^a are chain or link belts 17^b 17^b, adapted to receive the finished product after the same has been operated upon by the staple-setting devices and to carry such finished product on out of the machine. The forward ends of the chain or link belts 17^b are carried upon chain-wheels 17^a upon the cross-shaft 17, by means of which they are driven, and in order to hold the finished product down snugly upon the chains after passing through the staple-setting devices weighted arms 17^d are provided, adapted to rest upon the

upper face of the connected strips or slats x', as shown in Figs. 2 and 3, said weighted arms being hung on a cross-rod 17, suitably supported upon the extension 1^a of the machine-frame.

As shown in the drawings, the improved machine is provided with five sets of staple forming and setting or driving devices, so arranged as to permit of connecting the slats or strips x by means of five connecting-wires w w, one of said wires being extended transversely across each slat or strip near each end thereof, as shown in Fig. 14, and the remaining three wires being arranged at equal distances between these two outer wires. We do not desire to limit ourselves to the employment of any particular number of staple forming and setting devices, however, and there may be more or less than five of these provided.

Each set of staple forming and driving devices is carried upon a block or head 24, having on its rear face a transverse projection 25, adapted for engagement in a slot 27, formed longitudinally in a cross-bar or girth 28, extended transversely across and above the table of the machine-frame above the plane in which the slats or strips x are fed thereon, the ends of said cross-bar 28 being secured to uprights 38, extended up from the side pieces 1 of the frame at the rear part thereof, as shown in Figs. 1 and 2. By the engagement of their projections 25 in the slot 27 the blocks or heads 24 are held for horizontal adjustment toward and away from each other over the table of the machine to accommodate the machine to different lengths of slats or strips and different arrangements of the connecting-wires w therefor, and each projection 25 carries a screw 26, the head of which is adapted for engagement with the rear face of the cross-bar 28, by means of which screw the blocks or heads 24 may be locked when adjusted against movement [fol. 1621] along said bar.

Beneath each head or block 24 is an adjustable anvil 29, formed of a block of metal of suitable dimensions, having a shank 30 upon its under side and adapted to pass down through a slot 31, formed longitudinally in the cross-bar 5 of the machine-frame table, beneath which bar 5 the said shank has a screw 32, by means of which the anvil-plate may be locked fast to said bar when in adjusted position.

By this construction it will be seen that the anvil plates 29 may also be adjusted transversely of the machine-frame to correspond to the adjustment of the heads or blocks 24 upon which the staple forming and setting devices are carried.

The respective wires *w* and *w*, from which the connections of the strips or slats and the staples *y'* are formed, are carried on spools or reels 33 and 34, arranged in two series of five spools or reels, each upon a cross-beam 35 above the machine-frame, said beam 35 being supported at its ends upon braces 36, the lower ends of which are secured to the ends of a cross-piece or tie bar 37, which is extended across the machine between the upper ends of the upright portions 38 of the side pieces 1 1 of the frame.

Each block or head 24 has its staple forming and setting or driving devices so arranged and constructed as to insure that the staples *y'* when driven into the slats or strips *x'* over the connecting-wires *w* shall extend diagonally or obliquely with respect to said connecting-wires and also with respect to the grain of the wood, which is usually parallel with the sides of the slats or strips, and in this manner it will be seen that cracking or splitting of the strips or slats, such as is often caused where the staples are set at right angles to the connecting-wires and parallel with the grain of the wood, is avoided. This angular or oblique arrangement of the staples *y'* is effected by the arrangement of the staple forming and driving devices diagonally or obliquely with relation to the path in which the strips or slats are fed across the table of the machine-frame. The staple forming and driving or setting devices are carried upon the front parts of the respective blocks or heads 24, and in order to secure the diagonal or oblique arrangement of the staples when driven above referred to we make one side of each block or head 24 thicker than the other, so that its front surface will not be parallel with the direction of the cross-bar 28, whereon it is adjustably secured, but will be oblique or diagonal with relation thereto.

Each head or block 24 has at its lower part a shoe 24^a, formed with a forwardly and upwardly curved portion, beneath which the slats or strips *x* when fed by the chains are designed to readily pass, in position to be acted upon by the staple setting or driving devices, and the forward

and upper end of said curved portion of the shoe is provided with an apertured lug or pin 24^b, through which the end of the corresponding connecting-wire *w* is passed, said wire after being passed through the aperture of said lug or pin being drawn rearwardly under the block or head 24, the under side of which is provided with a groove or channel 24^c to receive and guide said wire. The under surface of the shoe 24^a is also grooved or channeled, as shown at 24^d for a similar purpose.

Each head or block 24 is formed with a removable face-plate 41, held by screws to the front or oblique surface of the head, and in the front surface of the head at the point covered by said plate 41 is provided a vertical guideway 40, a similar and corresponding guideway 42 being provided on the inner side of said face-plate 41. In the corresponding guideways 40 and 42 thus formed is arranged to play vertically a die or former 43, the upper end of which is extended above the head or block 24 and is carried by a block 44, having an upwardly-extended shank 45, the upper end of which is secured to a block or slide 46, held adjustably by screws 47 to a vertically-reciprocating cross-bar 49. The cross-bar 49 is extended transversely of the machine between the upright portions 38 of the frame, and its ends are guided for vertical movement in said upright portions 38. Said bar 49 is also provided with a longitudinal slot 48 of T shape in cross-section, and the screws 47 have heads engaged in said slot in such a way that when the nuts on the outer ends of said screws are loosened the slides or blocks 46 may be moved transversely of the machine in order to accommodate the position of these parts to any desired adjustment of the heads or blocks 24.

The cross-bar 49 has at each end a stud or lug 50, which is extended outwardly through a vertical opening 51 produced in the corresponding upright 38 of the machine-frame, and outside of the machine-frame each stud or lug 50 carries a swiveled head 52, with which is connected the upper end of an eccentric-rod 53, the lower ends of said rods being connected with the straps 54 of eccentrics 21 upon the opposite ends of the machine-shaft 22. By this construction it will be seen that as the machine-shaft is turned in the operation of the machine reciprocatory vertical movement will be imparted to the cross-bar 49 and

through the connecting parts above described, such motion being transmitted to the several dies or formers 43, so that vertical reciprocatory movement will be imparted to each such die or former.

Each of the wires *y* from which the staples *y'* are formed is carried downwardly adjacent to one of the heads or blocks 24 and has its extremity passed within and through a tubular guide 55, held in brackets 56, at one side of the inclined forward surface of the head or block 24, the lower end of the tubular guide 55 being curved or bent laterally, [fol. 1622] as shown at 57, in order to direct the wire when issuing from the guide in a lateral direction, as shown in Figs. 5 and 6, in position to be engaged in the bight of an upper and a lower feed-roller, these being indicated, respectively, at 59 and 61 upon the drawings. The peripheral surfaces of these feed-rollers may be grooved or otherwise formed in order to adapt them for engagement with the wire *y* to be fed. The upper roller 59 is held to turn freely on a screw-stud 60, held to the block or head 24 adjacent to one edge of the removable face-plate 41 thereof, while the lower roller 61 is held to turn loosely upon the reduced end portion 64 of a stud or pin 65, which stud or pin is passed through the head or block 24 and is adapted for free turning movement therein. The reduced end portion 64 of the stud or pin 65 is eccentric with respect to the body portion of said stud which turns in the head 24, and in this way it will be seen that as the wire *y* is passed through the bight of the feed-rollers from the bent end 57 of the guide 55 the rollers are permitted to separate to accommodate inequalities or unevenness in the wire; but should the wire *y* be drawn in a reverse direction, such as would withdraw its end from the bight of the feed-rollers, the eccentric arrangement of the lower feed-roller will cause said lower roller to clamp the wire *y* against the upper feed-roller and hold said wire *y* against disengagement from the feeding devices. The outer end of the reduced portion 64 of pin or stud 65 carries a block 68, having a slot wherein is held the lower end of a leaf-spring 66, the upper end of which has engagement with a pin 67 on the head or block 24 and is arranged in such a way as to normally press the lower feed-roller in position for clamping engagement against the upper feed-roller.

At the side of the face plate 41, adjacent to the feeding-rollers, is arranged a tubular wire-guide 58, also alined with the bight of said rollers and adapted for the passage of the end of the wire *y* after the passage of said wire between the said feed-rollers. This wire-guide 58 is arranged to carry the extremity of the wire *y* into the guideway in which the die or former 43 is arranged for movement, said die or former being of course raised at the time of the actuation of the feeding-rollers, so that the said wire may pass freely across the guideway beneath said die. For actuating the feed-rollers 59 and 61 to feed the wire *y* into the guideway of the die or former the upper feed-roller 59 is provided with a ratchet-wheel 69, secured upon it, and the teeth of said ratchet-wheel are adapted for engagement by the nose of a dog or pawl 70, the upper end of which is carried by a lever 71, pivoted on the face-plate 41 of the head or block 24. The opposite end of said lever 71 is engaged, as shown in dotted lines at 73 in Fig. 5, between the face-plate 41 and an arm 74, extended down from the head 44 of the die or former 43, and the lower end of said ram 74 is bent inward or toward the face-plate 41, as seen at 75 in Fig. 4, in position to engage, when the die or former is moved upwardly, beneath the said end 73 or lever 71 to oscillate said lever and impart downward movement to the nose of dog 70 in such a way that partial movement is imparted to the upper feed-roller 59. The upper feed-roller 59 carries a gear-wheel 62, adapted to mesh with a similar gear 63 on the lower feed-roller 61 in such a way that the intermittent rotative movement imparted, as above described, to the upper roller is communicated to the lower roller to insure proper feeding of the wire *y* through the guide 58 into the guideway of the die or former. A stop 76 is provided to limit the movement of the lever 71, and a spring 78 is provided to hold the nose of the dog 70 in proper engagement with the teeth of the ratchet-wheel 69.

At the rear of and communicating with the guideway of the die or former 43 is a recess or opening 79, formed in the head or block 24, and in said recess or opening 79 is arranged a movable part or jaw 80, held pivotally, as seen at 81, with its free lower end formed with a projecting front portion 82, adapted when said free lower end of the jaw is swung forwardly to enter and stand within the guide-

way of the die at the central part of said guideway. A spring 83, held on the rear face of the head or block 24, has connection with said jaw and is arranged to swing the same forward, so that its extended front portion 82 shall stand within the guideway of the die, as shown at Fig. 9. The extended front portion 82 of the jaw or part 80 has a notched or recessed part 84 at its center, and said notch or recess 84 is adapted when the jaw is swung into the guideway of the die to stand in alinement with the inner end of the wire-guide 58, so that when the wire *y* is fed into and is caused to extend transversely across the guideway of the die or former it will pass through the central notch or recess 84, as shown in Fig. 7, the die or former being of course raised at such time.

In the rear surface of the die or former 43 is produced a longitudinally-extended guideway or channel 87, and in the corresponding and adjacent surface of the block or head 24 is produced a coincident guideway or channel 88, and in these guideways or channels is adapted to move the driver or hammer 89, formed of an elongated metal bar or rod, the upper part of which is rectangular in cross-section to fit the walls of said guideways or channels. The driver or hammer 89 is of a length greater than the die or former, so that the upper end of said driver is extended above the block 44, on which the die or former is carried. The upper extremity of the driver is screw-threaded for en- [fol. 1623] gagement in a socket-piece or chuck 91, carried on the lower end of a rod 92, extended vertically in the machine-frame above the bar 49 and having its upper end passed through a slide-bearing 96 in the tie-bar or cross-piece 37 of the frame. The block 46, by which the stock or shank 45 is adjustably held to the actuating-bar 49, has an opening through which the hammer, bar 92, and chuck 91 are each free to pass in the movement of the parts vertically. The bar or rod 92 carries above the chuck 91 a nut 93, and above said nut a coiled spring 94 is held on the rod in such a way as to tend to press said rod, together with the driver connected therewith, in a downward direction. Above the tie-piece 37 and the rod 92 has a head 97, the lower part of which is formed with a square 98, and when said rod 92 is raised in the operation of the machine, as will be hereinafter explained said square 98 is adapted to

be engaged by the extremity of a trip-finger 99, held on a rock-shaft 100, mounted in bearings on the tie-bar 37. When the trip-finger 99 of the rock-shaft is engaged with the square 98 on the upward movement of rod 92, its upper extremity is engaged beneath said square and serves to hold the rod 92, together with the hammer 89, in raised position until the trip-finger shall in the further operation of the machine have been withdrawn from engagement with the square 98.

On the rock-shaft 100 is an arm 101, which has loose connection with the upper end of a rod 102, the lower end of which has sliding engagement in an opening formed in the cross-bar 28, on which the heads or blocks 24 are adjustably held, as indicated in dotted lines in Fig. 2, and on said rod 102 is adjustably held a collar 103, which is adapted for engagement beneath the vertically-reciprocating cross-bar 49 in such a way that when said cross-bar 49 is moved downwardly it will engage upon the collar 103 and draw the rod 102 also downwardly to rock the shaft 100 in its bearings and throw the trip fingers 99 out of engagement with the squares 98 on rods 92, whereby said rods are permitted to be moved forcibly downward under the impulse of the springs 95.

104 indicates a spring the lower end of which has engagement with the collar 103 and the upper end of which has connection with the cross-piece or tie-bar 37 of the frame, and when the bar 49 has reached the limit of its downward movement and commences to rise said spring 104 will retract the rod 102 and serve to rock the shaft 100 in a reverse direction, so that as the rods 92 are again raised the trip fingers 99 will be in position to again engage beneath the squares 98 to hold the rods in elevated positions.

For elevating the rods 92 upon the upward movement of the bar 49 the upper face of the block 44 has engagement against the under side of the chuck 91. In this way it will be readily understood that as the said block 44 is moved upward, carrying with it the die or former 43 in the upward movement of bar 49, the block will be engaged under the chuck 91 and will impart its upward movement to the rod 92 in such a way as to cause the same to slide vertically upward until the trip-finger 99 shall have engaged the square 98 to hold the rod raised, the hammer or driver 89 being

also by this movement raised and moved upward in its guideways.

The lower end of the guideway 87 for the driver in the die or former 43 is made in reduced width, as indicated at 87^a in Figs. 10 and 11, and the hammer 89 has the forward side of its lower end similarly reduced in width or thickness to correspond with and fit in said reduced portion. The reduced lower end portion of the driver has its opposite side surfaces formed with projecting longitudinal flanges or ribs 90, and these are adapted to fit and play in corresponding channels in the sides of the reduced portion 87^a of the guideway in the die to accurately guide the driver in its vertical movements. These channels or vertical grooves in the sides of the reduced portion 87^a of the guideway are adapted to receive the side portions or downwardly extended parts of the staples when said staples are formed by the downward movement of the die or former, and the said side portions of the staples have frictional engagement in said grooves or channels sufficient to hold the staples in place and prevent them from falling or dropping down in the guideway, even when freed from the dog, except when the staples are pressed down in being driven by the driver.

The movable part or jaw 80 has above its notch or recess 84 a forwardly and downwardly inclined cam-surface 85, and said cam-surface is in vertical alinement with the rear part of the driver, which plays in the guideway 88 in block 24, since the said jaw is forced by its spring 83 forward when the driver is raised until the extended front portion 82 of the jaw comes to stand in the guideways 87 and 88, as shown in Fig. 9. The said rear part of the driver has its lower end beveled off to form a cam surface 90, adapted when the driver is moved downward under the impulse of the spring 95 to engage upon the cam-surface of the jaw or part 80 in such a way as to throw the lower end of said jaw rearward and out of the path of the driver 89, which latter is thus permitted to be pressed forcibly down by its spring until its lower end shall have passed below the jaw and have driven the staple beneath it through the slat or piece x' to hold a wire x thereto.

In the operation of the improved machine we prefer to so time the parts that the machine-shaft 22 shall at each

turn impart, through ratchet wheel 18 and its connected mechanisms, a feeding impulse to the chains 15 sufficient to [fol. 1624] move each slat or strip with which the chains are engaged a distance equal to half the width of a slat or strip plus half the distance by which the slats or strips are spaced or separated. We also so time the staple forming and driving or setting devices as to be actuated once for each feeding movement of the slats or strips, so that by this arrangement of the parts each strip or slat of veneer is attached to each of the connecting-wires x by two diagonally or obliquely set staples, as indicated in Fig. 14. By this arrangement a much firmer and stronger attachment of the slats to the wires x is attained, so that considerable strength and stiffness are added to the crates or boxes and also the use of wider slats or strips z is permitted without liability of their being cracked or split. At each turn of the machine shaft 22 an impulse is imparted to the feeding mechanisms to bring a slat beneath the staple driving and forming devices carried on the blocks 24 in position to have a fresh transverse series of staples driven therein to hold the connecting-wires x to said slat. Each turn of the shaft 22 also actuates the vertically-reciprocating bar 49 so as to move the same first downward and then upward. In the downward movement of said bar 49 the die or former 43, which before had been in raised position, as indicated in Figs. 6, 7, and 9, is moved downward in its guideways in the block 24 and face-plate 41, and one side thereof serves to cut through and sever the horizontally-extended end portion of wire y at the point where it extends from the guide 58 into the guideway of the former, the severed end portion of said wire being meanwhile held at its center in the notch or recess 82 of the jaw 80, which latter is pressed by its spring so that its forwardly-extended lower part shall stand in the guideway 87 in the die or former. As the die or former continues to move downward the portions thereof at the sides of the said guideway 87 are caused to press downward upon the extremities of the severed portion of the wire y, so that said extremities are bent downward at the sides of the extended part 82 of the jaw, so that the said severed portion of the wire y is bent into the form of a staple, as indicated at y' in Fig. 8. The downward movement of the die or former 43 is continued until the lower

end thereof comes to bear upon the top surface of the slat or strip x which is in position to receive the staple y', the engagement of said die with the slat serving to securely hold the slat in position while the staple is being driven. While this farther downward movement of the die is taking place the staple y', formed as above described, is held in the guideway 87 by the engagement of the jaw with the central part of the staple. As the bar 49 reaches the limit of its downward movement and the die or former is firmly pressed at its lower end upon the slat or strip x beneath the head or block 24 the said bar 49 comes in engagement with the collar 103 on rod 102 and serves to draw said rod downward, the lower end of the rod sliding in its guide-recess in bar 28 and serving to rock the shaft 100, whereby the trip-fingers 99 are withdrawn from engagement beneath the squares 98 and the springs 95 are permitted to forcibly press the rods 92 downward. In the downward movement thus imparted to each driver 89 (owing to its connection with the corresponding rod 92) the cam-surface 90 at the lower rear part of the driver comes into engagement with the cam-surface 85 upon the extended part 82 of jaw 80 and serves to swing the free lower end of said jaw backward or rearward in its recess 79 against the tension of its spring 83, so that the jaw is moved out of the way of the descending driver. In its withdrawal from the guideways 87 and 88 the jaw is caused to release the staple y', which had been supported by it in the guideway 87, and said staple is engaged by the lower forward end of the driver, which is made flattened, and is thereby pressed downward within the guideway 87 and is driven through the slat or strip x, held beneath the die, the downwardly-extended sides of the said staple being at opposite sides of the connecting-wire w, whereby the said wire is held to the slat or strip x. The arms or sides of the staple y' after being passed through the slat or strip will be clenched upon the under side thereof upon engagement with the anvil-plate 29 beneath the slat or strip. The staple y', having been formed and driven as above described, the continued movement of the shaft 22 will serve to raise the bar 49, and with it the die or former 43, the driver remaining pressed downward by its spring, with its chuck 91 rested on the block 44, so that said driver is also raised by the upward movement of the die or former

until the square 98 at the upper end of rod 92 is engaged and held in raised position by the trip-finger 99 on the rock-shaft 100, the upward movement of the bar 49 having also permitted the spring 104 to turn the rock-shaft so that the trip-fingers are in position to engage under the squares 98 on rods 92. As the die is raised the lever 71 is moved pivotally by the engagement therewith of the bent lower end 75 of arm 74 on block 45, and this movement of the lever causes the dog 70 to be pressed downward, its nose engaging the teeth of ratchet-wheel 69 in such a way as to turn said ratchet-wheel, and with it the upper and lower feed-wheels 59 and 61, so that a feeding impulse is imparted to the wire w to cause its extremity to again pass through the guide 58 and to be extended across the guideway between the block 24 and its face-plate 41 and in which the die or former plays. As the die and driver are moved upward the jaw or part 80 will also be pressed by its spring 83 in such a way as to cause its notched or recessed extension 82 [fol. 1625] to again stand in the guideways with its notch in position for the extremity of the wire w to pass through in order that the next staple w' may be formed. The feeding operation for the slats is then repeated to bring the same slat or another slat or strip in position for the next staple w' to be set or driven, and since the wires w are connected or attached to the slats or strips by the staples w', driven as above described, this succeeding slat or strip feeding impulse will serve to draw off from the reels or spools 33 a length of wire sufficient to extend to the point where the next staples are to be set or driven. The operations above described are continued as the shaft 22 revolves, and the connected strips or slats may be made in any desired lengths or may be run continuously through the machine and afterward cut into any suitable lengths.

From the above description of our improvements it will be seen that the improved machine is of an extremely simple and inexpensive nature and is strong and durable and requires no special skill or knowledge upon the part of the operative in charge, since its working is substantially automatic. The operation of the improved machine is also very rapid, so that the connected slats or strips are produced ready for use in making boxes or crates in very little time and at comparatively small expense. The machine

is also of such a nature as not to be liable to be readily broken or deranged when in use, and its parts are constructed in such manner that they may be readily taken apart and reassembled, so that in case of breaking down or stoppage they may be readily removed and replaced with little labor and in a short time. It will also be obvious from the above description that the improved machine constructed according to our invention is capable of considerable modification without material departure from the principles and spirit of the invention, and for this reason we do not desire to be understood as limiting ourselves to the precise form and arrangement of the several parts of the device as herein set forth.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

1. In a machine of the character described, the combination of a head, wire-feeding mechanism, a die movable on the head, mechanism for moving the die, a jaw movable on the head and having a part to receive a wire and around which the said wire is bent to produce a staple when the die is moved, a driver and actuating means therefor, a trip device for holding the driver against movement, said driver being arranged to move in one direction in unison with the die and means operated from the die-moving mechanism to release the driver from said trip device, substantially as set forth.

2. In a machine of the character described, the combination of a head, wire-feeding mechanism, a die movable on the head, mechanism for moving the die, a jaw movable on the head and having a part to receive a wire and around which the wire is bent to produce a staple when the die is moved in one direction, a driver movable in unison with the die in one direction, a trip device arranged to hold the driver against return movement when so moved in unison with the die, a spring for moving the driver in an opposite direction and means operated from the die-moving mechanism for actuating said trip device to release the driver, substantially as set forth.

3. In a machine of the character described, the combination of a die mounted for reciprocatory movement, a mov-

able jaw adapted to support a wire in line with the die when said die is moved in one direction, said die when moved in an opposite direction being adapted to engage and bend the ends of a wire so held around said jaw to produce a staple, means for moving said die, a driver having means to actuate it independent of the movement of said die, means to hold the driver out of operation during the actuation of the die and mechanism to release the driver from said holding means and means whereby the die-moving mechanism actuates the releasing mechanism, substantially as set forth.

4. In a machine of the character described, the combination of a frame, staple-driving devices carried thereon, slat-feeding devices having parts to engage slats and arranged to feed slats so engaged beneath the staple-driving devices, actuating means for said slat-feeding devices, said actuating means being arranged to move the slat-feeding devices intermittently and to an extent less than the distance between the slat-engaging parts of the slat-feeding devices whereby, in the operation of the machine, two staples are driven in each slat and means to actuate the staple-driving devices after each operation of the slat-feeding devices.

5. In a machine of the character described, the combination of a head, wire-feeding mechanism, staple-forming means, a driver independent of the staple-forming means and adapted to drive a staple when formed, means to actuate the driver mechanism comprising a reciprocating part the movement of which, in one direction, is communicated to the actuating means of the driver and in the other direction, is communicated to the staple-forming means to actuate the same to produce a staple, and means to release the actuating means for the driver.

6. In a machine of the character described, the combination of a head, wire-feeding mechanism, staple-forming means, a driver independent of the staple-forming means and adapted to drive staples when formed, means capable of being placed under tension and, when released, adapted to actuate the driver mechanism comprising a reciprocat- [fol. 1626] ing part, the movement of which, in one direction,

is communicated to the actuating means of the driver to place the same under tension and in the other direction, is communicated to the staple-forming means to actuate the same to produce a staple, and means to release the actuating means for the driver.

7. In a machine of the character described, the combination of means to form and support a staple to be driven, a driver arranged for movement in line with the staple-supporting means, a spring for moving the driver, mechanism arranged to actuate the staple-forming means, means actuated in unison with the operation of the actuating mechanism of the staple-forming means and arranged to place said spring under tension, a detent device for holding the driver against operation while the staple is being formed and means to release the driver after the operation of the staple-forming means.

8. In a machine of the character described the combination of means to form and support a staple to be driven, a driver arranged for movement in line with a staple-supporting means, a spring for throwing the driver to drive the staple, a trip device for holding the driver against the tension of its spring and movable actuating mechanism connected with the staple-forming means and also connected with the trip device and movable for successively actuating the staple-forming means and said trip device.

9. In a machine of the character described the combination of means to form and support a staple to be driven, a driver arranged for movement in line with the staple-supporting means, a spring for throwing the driver to drive the staple, a trip device for holding the driver against the tension of its spring and means for successively actuating first, the spring to place it under tension, second the staple-forming means to form a staple and third, the trip device to release the driver.

10. In a machine of the character described the combination of means to form and support a staple to be driven, a driver arranged for movement in line with the staple-supporting means and mechanism reversely movable for successive operation to first actuate the staple-forming means to produce a staple and afterward to release the driver to permit movement of the same to drive said staple.

No. 806,411 PATENTED DEC. 5, 1905.

R. G. INWOOD & P. C. LAVENBERG.

MACHINE FOR MAKING BOX BLANKS.

APPLICATION FILED JAN. 3, 1905.

6 SHEETS—SHEET 1.

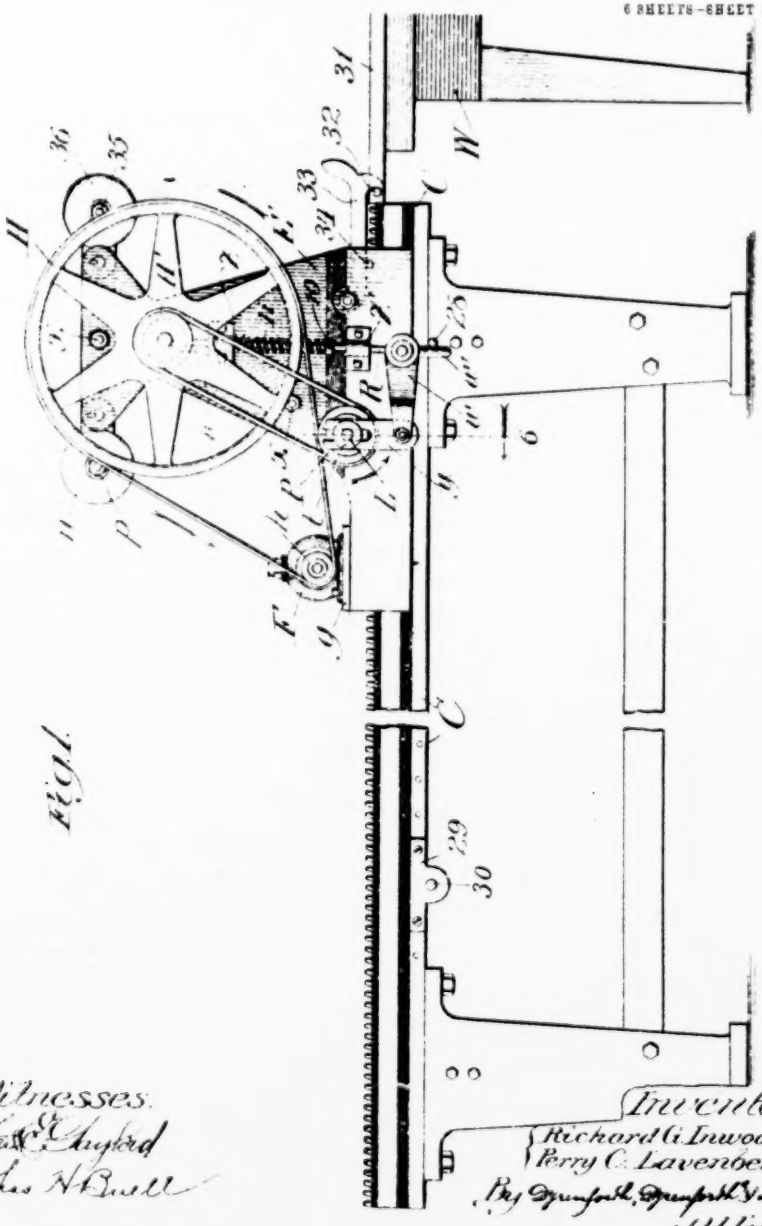

Fig. 1.

Witnesses.
Chas. E. Taylord
Chas. H. Bull

Inventors.
Richard G. Inwood,
Perry C. Lavenberg.
By Dumford, Dumford & Lee,
Attys.

No. 806,411. PATENTED DEC. 5, 1905

R. G. INWOOD & P. C. LAVENBERG.

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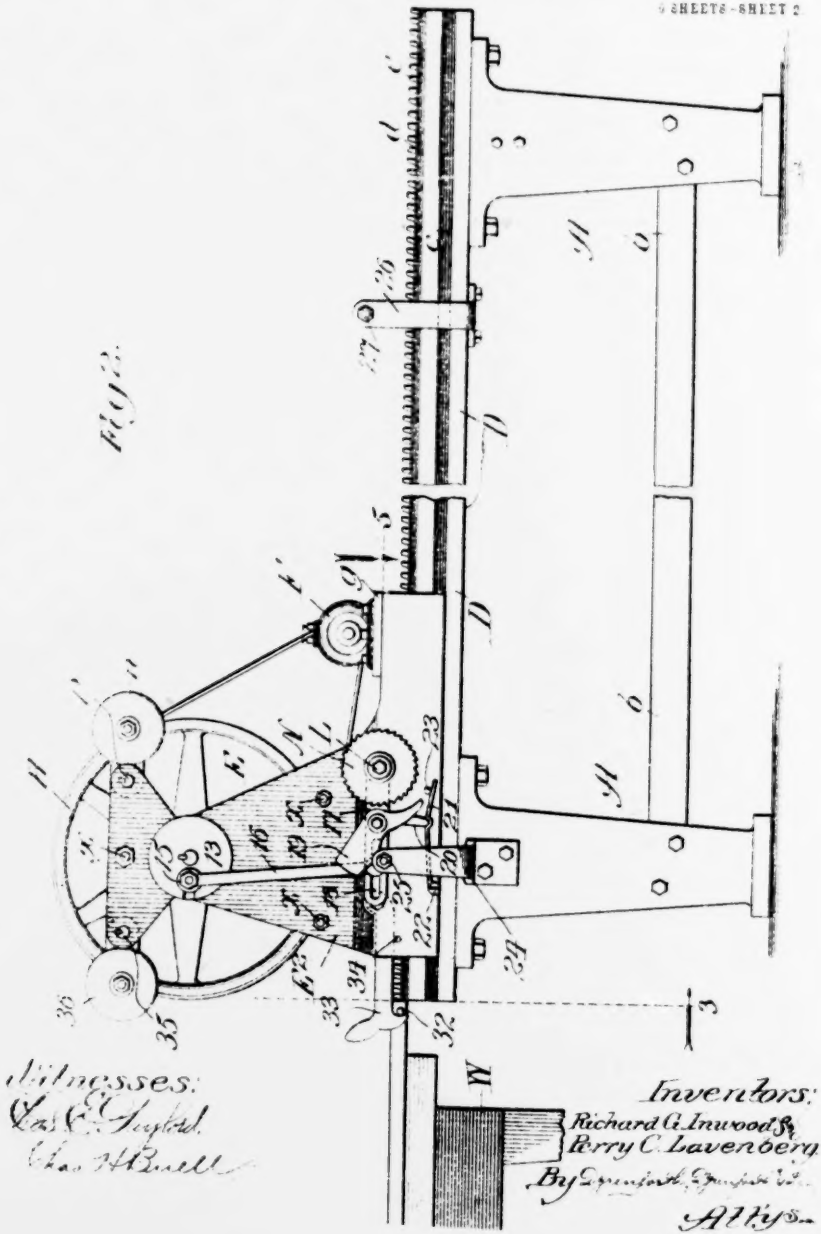
3 SHEETS-SHEET 2



Witnesses:
Chas. E. Sayford.
Chas. H. Buell.

Inventors:
Richard G. Inwood &
Perry C. Lavenberg
By Dyrenforth, Dyrenforth & Lee
Attys.

No. 806,411. PATENTED DEC. 5, 1905.

R. G. INWOOD & P. C. LAVENBERG.

MACHINE FOR MAKING BOX BLANKS.

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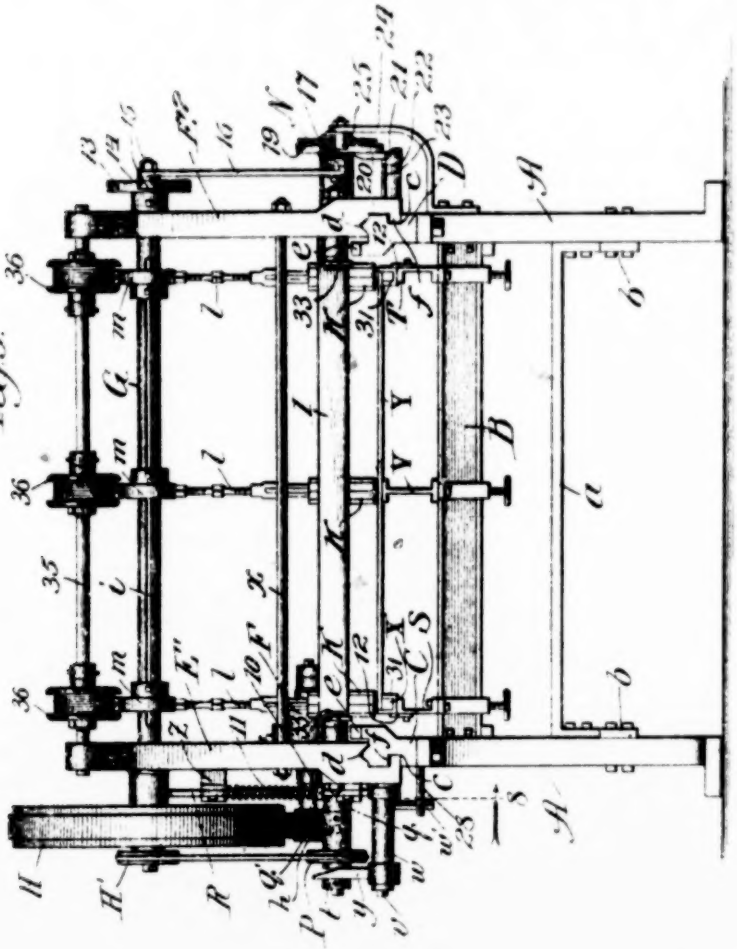
6 SHEETS-SHEET 3

Fig 3.



Witnesses:
Chas. H. Buell.

Inventors.
Richard G. Inwood &
Perry C. Lavenberg.
By Dunlap & Dunlap & Co.
Attys.

No. 806,411. 1633-1634

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R. G. INWOOD & P. C. LAVENBERG.

MACHINE FOR MAKING BOX BLANKS.

APPLICATION FILED JAN. 3, 1905.

9 SHEETS-SHEET 4.

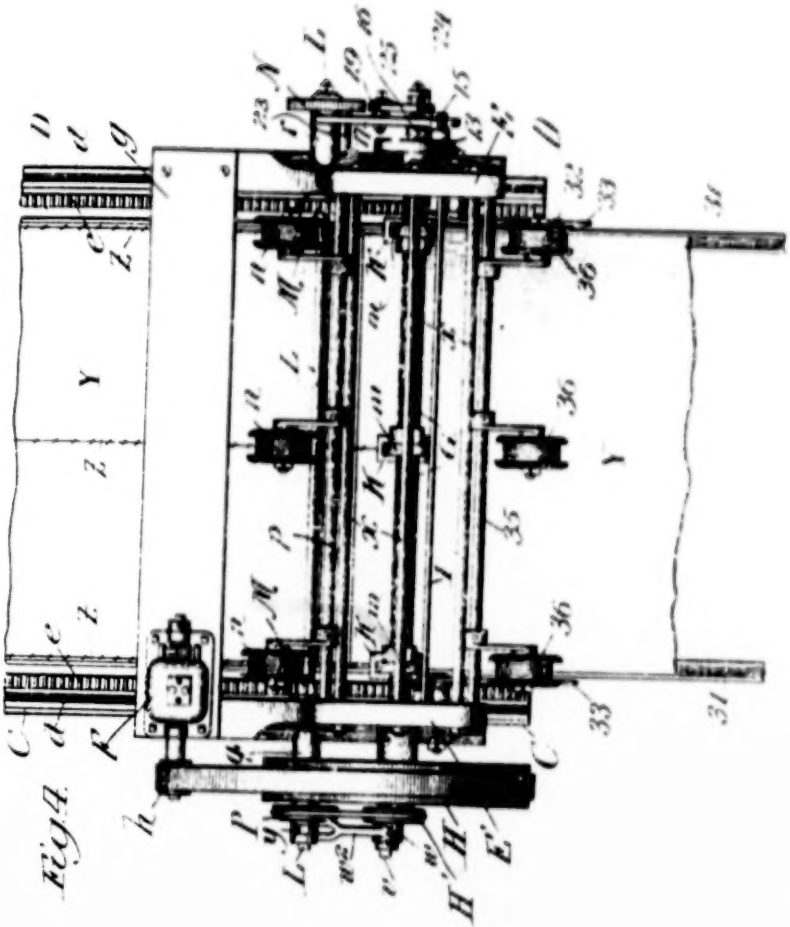


Fig 4.

Witnesses:
Chas. E. Taylor
Chas. H. Buell

Inventors:
Richard G. Inwood &
Perry C. Lavenberg
By Dyrenforth, Dyrenforth & Co.
Attys.

No. 806,411

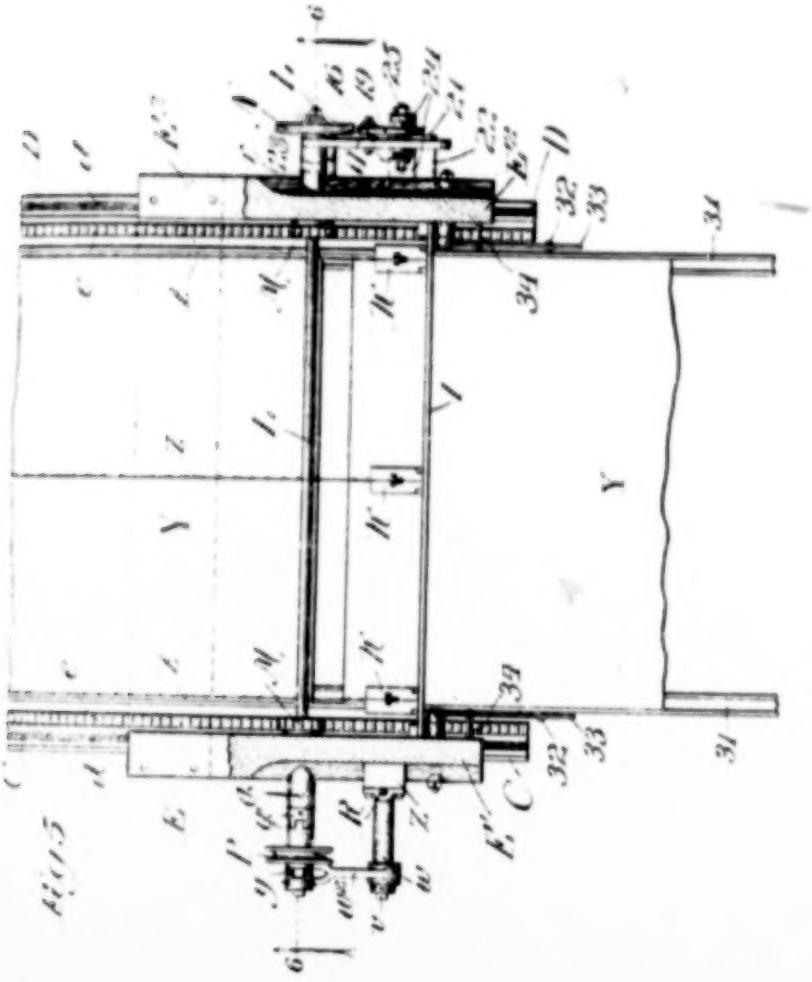
PATENTED DEC. 5, 1905.

R. G. INWOOD & P. C. LAVENBERG.

MACHINE FOR MAKING BOX BLANKS.

APPLICATION FILED JAN. 3, 1905.

6 SHEETS—SHEET 5.



Witnesses:

Inventors:
Richard G. Inwood &
Perry C. Lavenberg,
By [illegible] & Dyrenforth & Co.,
Attys.

No. 806,411. 1637-1638

PATENTED DEC. 5, 1905.

R. G. INWOOD & P. C. LAVENBERG

MACHINE FOR MAKING BOX BLANKS

APPLICATION FILED JAN. 3, 1905.

6 SHEETS—SHEET 5.

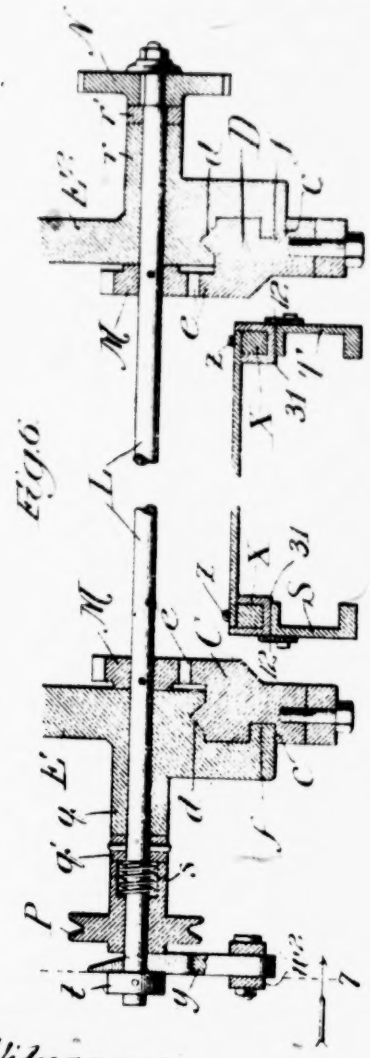


FIG. 6.

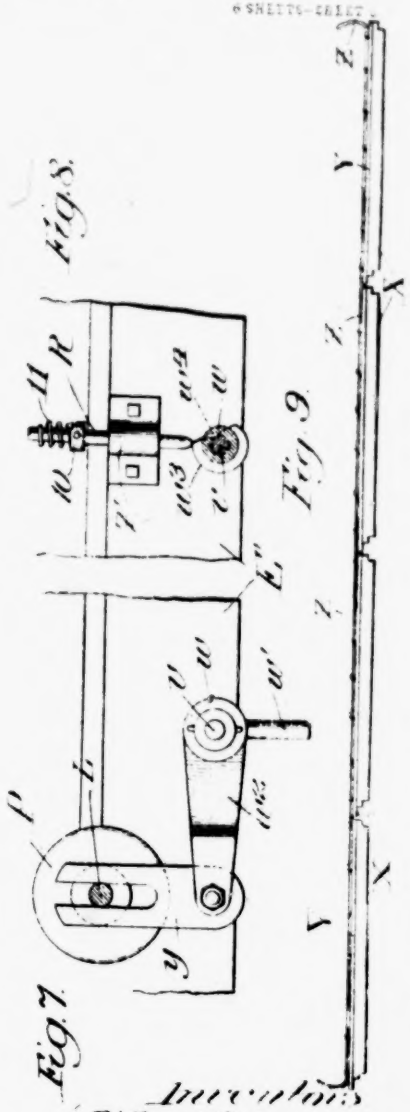


FIG. 8.

FIG. 9.

FIG. 7.

Witnesses:
C. E. Taylor
Chas. H. Bull

Inventors:
Richard G. Inwood &
Perry C. Lavenberg
By Crosby & Gregory, Att'ys.

Signed at Chattanooga, Tennessee, this 3d day of May, 1902, and 17th day of May, 1902, respectively.

Wm. Lipps, Isaac Springer.

Witnesses as to Wm. Lipps: R. Toombs Wright, W. G. M. Thomas, Battle McLester.

Witnesses as to Isaac Springer: W. G. M. Thomas, Battle McLester.

(Here follow side folios 1627-1638.)

[fol. 1639] United States Patent Office

Richard G. Inwood and Perry C. Lavenberg, of South Bend, Indiana, Assignors to the National Wire Bound Box Company, of South Bend, Indiana, a Corporation of Indiana

Machine for Making Box-blanks

No. 806,411. Specification of Letters Patent. Patented Dec. 5, 1905

Application filed January 3, 1905. Serial No. 239,415

To all whom it may concern:

Be it known that we, Richard G. Inwood and Perry C. Lavenberg, citizens of the United States, residing at South Bend, in the county of St. Joseph and State of Indiana, have invented a new and useful Improvement in Machines for Making Box-Blanks, of which the following is a specification.

Our invention relates to improvements in machines for tacking, preferably with staples, assembled members of blanks or the like for the purpose of fastening them together, and more especially for stapling to each other sheets, cleats, and binding-wire in proper relation to produce blanks for wire-bound receptacles, boxes, or other packages. The wire-bound boxes referred to are usually rectangular in shape, having solid ends, the four sides being of thin lumber or veneer, reinforced with inside cleats

step-mitered together at their ends, and binding-wires extending around the said four sides.

Our object is to provide a machine of novel and improved construction for making more especially the reinforced veneer blanks intended for the four sides of boxes, as described, which machine shall be of particularly simple and durable construction, easy to operate, and capable of manufacturing the finished blanks with comparatively great rapidity and certainty.

In the operation of our improved machine in its preferred form the cleats and sheet or sheet-sections necessary for a blank are assembled in a device called a "former" adapted to receive and hold the parts in proper relation and passed with the former onto the bed of the machine to remain stationary during the stapling operation. On the machine is a traveling carrier with driving means for moving it intermittently toward one, preferably the feed, end of the machine and for reversing it when it has reached said end and moving it rapidly toward the other end of the machine, the reciprocating movement of the carrier intermittently in one direction and steadily in the opposite direction being continuous. On the carrier are stapling devices which may be staple forming as well as driving devices, actuated in the intermittent movement of the carrier to staple the blank material for the purpose of fastening the sheet and cleats together and alternating in their staple-driving operations with the traveling movements of the carrier. Means are also provided on the carrier for feeding binding or strengthening wires beneath the staples to be straddled thereby as they are driven through the sheet into the cleats. In the present machine the reciprocating movements of the carrier and stapling devices are produced by power from an electric motor mounted upon the carrier, and means are also provided for causing the carrier in its return movement to discharge the finished blank and its former from the machine and at the same time draw another former with cleats and sheets assembled thereon into the machine to be stapled together and reinforced with binding-wires.

Referring to the accompanying drawings, which show our machine of one desirable construction, Figure 1 is a broken elevation of one side of the machine; Fig. 2, a

similar view of the opposite side of the machine; Fig. 3, a partly-sectional end view taken on line 3 in Fig. 2; Fig. 4, a broken plan view of a portion of the machine; Fig. 5, a plan section taken on line 5 in Fig. 2; Fig. 6, an enlarged broken vertical section taken on line 6 in Fig. 5 and showing certain details of the construction; Fig. 7, a fragmentary section taken on line 7 in Fig. 6; Fig. 8, an enlarged fragmentary section taken on line 8 in Fig. 3; and Fig. 9, an edge view of a finished box-blank, indicating by dotted lines the manner of folding the blank to form the sides of a box.

The bed-frame of the machine is upon legs A, suitably braced by lower cross-bars *a* and longitudinally-extending bars *b*, upper cross-bars B, and longitudinally-extending top side rails C D, all fastened together with bolts. The top rails C D are formed with longitudinally-extending grooves *c* in their outer sides, longitudinally-extending V-shaped guides *d* on their upper sides, and longitudinally-extending racks *e* on their upper inner sides.

E is a carrier or carrier-frame having the side cheeks E' E² preferably of the shapes indicated and fastened together with the tie-rods *x*. The lower parts of the cheeks have tongues *f* fitting the grooves *c* of the stationary side rails, and V-shaped grooves fitting the V-shaped guides [fol. 1640] or tongues *d*, as shown most plainly in Fig. 6. Connecting the cheeks at one end is a cross-plate *g*, upon which is mounted an electric motor F, having an armature-shaft carrying a belt-pulley *h*. Journaled at opposite ends in the cheeks E' E² is a shaft G, provided between the cheeks with a longitudinally-extending feather or groove *i*. Loosely mounted upon the shaft G at the outer side of the cheek E' is a large pulley or fly-wheel H. Between the hub of the pulley H and the shaft G is a clutch of common construction, which it is not thought necessary to show in detail in the present connection. It will suffice to say that it is of the well-known type, which consists of a semicylindrical rod fitting a semicylindrical groove in the shaft and adapted when turned on its axis to enter a semicylindrical groove in the hub of the fly-wheel. The rod has a latterally-projecting arm *k*, Fig. 1, which when moved in the rotation of the shaft against a stop turns the semicylindrical clutch-rod to release its engagement with the fly-wheel, whereby

the latter rotates loosely upon the shaft without turning the same. Extending between the cheeks E' E² in the position shown is a cross-bar I, upon which are slidably mounted stapling devices K. These devices are actuated by connecting-rods *l*, reciprocated by eccentrics *m* on the shaft G. The hubs of the eccentrics fit the groove or feather *i* on the shaft in a manner to rotate with the shaft and permit their being slid longitudinally of the shaft for purposes of adjustment in adjusting the staple-drivers.

Any suitable form of staple-driver K may be employed, and we prefer to provide devices which will form the staples and then drive them in the downstrokes of the connecting-rods *l*. In the figures we have shown spools *n*, adjustably mounted upon a shaft *p* for supplying wires to the stapling devices, from which the staples to be driven are formed in a common manner.

Extending through sleeve-bearings *q* on the cheek E' and *r* on the cheek E² (see Fig. 6) is a shaft L, provided beyond the said bearings with collars *q'* *r'*, respectively, as shown. Fastened to the shaft L at the inner sides of the cheeks are gear-wheels M M, engaging the longitudinal racks *c*. Keyed to the shaft L beyond the washer or collar *r'* is a ratchet-wheel N. Loose upon the shaft beyond the collar *q'* is a pulley P, belted, as shown in Figs. 1 and 3, to a pulley H', integral with the hub of the fly-wheel H. The hub of the pulley P and the collar *q'*, which is fast to the shaft, are provided on their adjacent faces with intermeshing teeth, forming them into clutch members normally held apart by an intervening spring *s*. The spring *s* tends to slide the pulley P toward a collar *t* at the end of the shaft, thereby disengaging the clutch members and causing the pulley P to rotate loosely on the shaft L. Loosely surrounding a stub-shaft *v*, extending outward from the lower edge of the cheek E', is a sleeve *w*, provided toward its inner end with a downwardly-extending pin *w'* and toward its opposite end with an arm *w²*, having a bifurcated end. Pivotally mounted in the bifurcated end of the arm *w²* is a bifurcated wedge *y*, movable across the shaft L between the pulley or clutch member P and collar *t*. Integral with the sleeve *w* at its inner end is a cam *w³*. (Shown most plainly in Fig. 8.) Passing through guides *z z'* on the cheek E' is a plunger-rod R. On the rod above the guide *z'* is a

collar 10, and surrounding the rod and confined between the collar 10 and guide *z* is a spring 11, which tends normally to press the rod in the downward direction. The rod R at its lower end rests upon the cam a^3, and when engaging the depressed portion a^4 of the cam is at its upper end out of the path of the arm *k* of the clutch, which, as before stated, is between the fly-wheel H and shaft G.

Fastened upon the cross-bars B of the bed-frame are longitudinally-extending bars S T V. The bars S and T are channel-bars, as shown, and the bar S may be permanently fastened in place directly under the staple-driver at that side of the machine. The bar T may be slid laterally to position it under the staple-driver at that side wherever the same may be adjusted. On the outer upper edges of the bars S T are raised guide-flanges 12. In the machine illustrated the bar V is in the form of an I-beam, terminating at its upper end in a plane above the tops of the bars S T for the purpose hereinafter described. The bar V may be adjusted laterally to register with the intermediate staple-driver K shown.

Keyed to the end of the shaft G beyond the cheek E^2 is a disk 13^4, provided at one side with a radially-extending dovetail slot 14. Fastened in the slot 14 is a slidingly-adjustable block 15, to which is pivotally secured at its upper end a connecting-rod 16. Fulcrumed at one end upon the shaft L is a swinging lever 17, provided along its free end portion with a slot 18. The connecting-rod 16 is pivotally connected at its lower end to the lever 17 at the slot 18, along which it may be adjusted and fastened in adjusted position.

19 is a counterweighted pawl pivotally mounted upon the lever 17, as indicated, and adapted normally to engage the ratchet-wheel N, which is keyed to the shaft L. On the swinging pawl is a finger 20, adapted to engage the socket of a spring 21, which is fastened against the cheek E^2 at 22 and bears normally against a pin or stop 23 on the cheek, as shown in Fig. 2. On the bed-frame in the position shown is a permanent bracket 24, carrying an inwardly-projecting pin 25 in the path of the under inclined or cam-shaped edge [fol.1641] of the weighted side of the pawl 19. Adjustable along the bed-frame is a bracket 26, also carrying an inwardly-extending pin 27 in the path of the upper edge of

the weighted side of the pawl 19. In the path of the downwardly-projecting arm or finger n' of the sleeve n in the position shown is a fixed pin or stop 28, and adjustable along the side of the bed-frame is a bracket 29, carrying an outwardly-extending pin, 30, also in the path of the finger n'.

Beyond the receiving end of the bed-frame is an assembling-table W. The former before mentioned consists in whole or in part of a pair of channel-bars 31. (Shown in section in Fig. 6.) The channel-bars are provided near their forward ends with laterally-projecting pins 32. On the inner side of each cheek of the carrier E is a swinging latch 33, resting normally upon a stop 34 and adapted to engage the pins 32 on the sides of the former-bars.

Parallel with the shaft p on the opposite side of the carrier frame is a shaft 35, carrying laterally-adjustable spools 36 for strengthening-wires which unwind from the spools and pass beneath the staple-drivers to be straddled by staples in the manner common in machines of this class.

In operation the electric motor F drives the fly-wheel H. The drawings show the carrier E at the limit of its travel at the receiving end of the machine. The pin n' has contacted with the stop 28, thereby rocking the sleeve n to cause the cam n^2 to raise the rod R, as shown in Fig. 8, and move the upper end of said rod in the path of the clutch-arm k, whereby the fly-wheel H and its pulley H' rotate loosely upon the shaft G without turning the latter. The arm n^3 on the sleeve n has been raised in the rocking motion of the sleeve described to move the wedge q to the position shown in Fig. 6, whereby the clutch members P p' are in engagement and rotate the shaft L to turn the pinions M and cause the carrier to be moved thereby along the rack toward the discharge end of the machine. In the movement of the traveling carrier to the receiving end of the machine the weighted end of the pawl 19 has engaged and slid upon the pin 25 and been swung thereby to the position shown in Fig. 2, wherein the finger 20 has been caught by the socket of the spring 21 to hold the pawl out of engagement with the ratchet-wheel X. Cleats X, of the form shown in cross-section in Fig. 6 and in side elevation in Fig. 9, are placed by an attendant in the parallel channel-iron former-bars 31 to extend with relation to each

other, as shown in Fig. 9, and sheets Y of veneering are placed by the attendant upon the cleats in the former. The former with the sheets and cleats in position are passed along the assembling-table W to the position indicated in Figs. 1, 2, and 5, whereby as the traveling carrier reaches the position shown the latches 33 engage the pins 32. The turning of the fly-wheel, pulley H' thereon, and pulley P, which, as stated, is then clutched to the shaft L, causes the latter to be rotated in the direction of the arrow, Fig. 1, to turn the pinions M and move the carrier rapidly toward the discharge end of the machine. This travel of the carrier continues until the arm n' contacts with the pin 30 and the top of the weighted end of the pawl strikes the pin 27. The first said action causes the sleeve n and attendant parts to be rocked, whereby the rod R descends in the part n^4 of the cam and the wedge n is withdrawn from between the collar l and pulley or clutch member P. The disengagement between the clutches P and q' thus effected stops rotation of the shaft and pinions M, thereby stopping the movement of the traveling carrier. The release of the clutch-arm k by the rod R throws the shaft G into engagement with the fly-wheel, to be rotated thereby.

In the movement of the carrier from the position shown to the end of its travel toward the discharge-end of the machine the latches 33, owing to their engagement with the pins 32 on the former-bars, draw the latter, with the cleats and sheets assembled therein, into position on the bed-frame. When the shaft G begins to rotate, the pawl 19, which has been released from engagement with the spring 21 through its contact with the pin 27, is swung up and down to give intermittent motion to the ratchet-wheel N, and thereby rotate the shaft L intermittently and produce intermittent travel of the carrier in the direction of the feed end of the machine. The parts upon the shaft G are so arranged with relation to each other that in the down-stroke of the connecting-rod 16, which produces turning of the shaft L and travel of the carrier, as described, the connecting rods l and the staple-drivers are raised, and in the rise of the connecting-rod 16, which disengages the pawl from the ratchet and stops movement of the carrier, the connecting rods l are plunged downward to cause the staple forming and driving machines to drive staples. As the

carrier moves thus intermittently the binding-wires Z from the spools 36 pay out, so that the staples straddle the wires as they are driven through the sheets into the cleats at opposite edges of the blank. The central staple forming and driving device K is adapted to form relatively small staples, which when driven straddle the central binding-wire and are clenched under the sheet Y against the anvil formed by the bar V. By adjusting the connecting-rod 16 at its upper end along the slot 14 or at its lower end in the slot 18 of the lever 17, or both, the sweep of the pawl in each downward movement may be regulated to regulate [fol. 1642] the distance of travel of the carrier between the stapling operations. Thus the staples may be driven at the desired distance apart.

While one blank is being stapled or "stitched," as described, the attendant assembles material for another blank in another pair of former-bars 31 and pases them into the end of the machine in position to be engaged by the latches 33 when the carrier completes its intermittent travel toward the feed end, Preferably the blank material is passed far enough into the machine to receive one or two staples before the traveling carrier stops, whereby in the return movement of the carrier the latter positively engages the blank material, as well as the former-bars, to draw them into the machine, as before described. In drawing the material for a blank into the machine the carrier discharges the finished blank from the machine and another attendant thereupon severs the binding-wires between the blanks to cause the ends of the wires Z to extend approximately as shown in Fig. 9.

The binding-wire spools, staple-wire spools, and stapling devices may be adjusted along their shafts for operating upon blanks of any desired width, and the brackets 26 29 may be shifted along the bed-frame to stop and reverse the carrier at any point depending upon the length of the blanks. Thus it will be readily seen that the machine may be very quickly adjusted to different sized blanks. The machine may operate as fast as an attendant can place the formers, with the assembled blank material thereon, in position. The speed of intermittent travel of the carrier would only be limited by the speed at which the staple forming and driving devices may safely operate, and the return

movement of the carrier may be at any desired speed. Thus the capacity of the machine for manufacturing box-blanks is only limited by the speed at which a skilled attendant may be able to place the formers with the blank material in the machine.

While we prefer to construct the machine throughout as shown and described, it may be variously modified in the matter of details of construction without in any way departing from the spirit of our invention as it is defined by the claims.

What we claim as new, and desire to secure by Letters Patent, is—

1. Mechanism for making wire-bound box-blanks by stitching together the parts of the blank material, comprising, in combination, a stationary frame, a traveling carrier with means for moving it longitudinally of the frame, a plurality of stapling devices with operating means therefor on the carrier, cleat and sheet assembling mechanism movable longitudinally into and out of a position on the frame wherein the material will be traversed by the carrier, and means operating in the travel of the carrier to position binding-wires beneath the stapling devices along the sheets.

2. Mechanism for making wire-bound box-blanks by stitching together the parts of the blank material, comprising, in combination, a stationary frame, a traveling carrier with means for moving it longitudinally of the frame, a plurality of stapling devices with operating means therefor on the carrier, cleat and sheet assembling mechanism movable longitudinally into and out of a position on the frame wherein the material will be traversed by the carrier, the parts being constructed and arranged whereby the material and staple-drivers remain in fixed relation to each other while staples are being driven, and means operating in the travel of the stapling devices to feed binding-wires between them to the said material.

3. In a machine for making blanks of the character set forth, the combination with a bed on which the assembled blank material is positioned, of a traveling-carrier frame, means for moving the frame intermittently to cross the positioned blank material, intermittently-operating staple-

drivers on the carrier-frame alternating in their staple-driving operations with the movements of the carrier-frame and operating means for the staple-drivers.

4. In a machine for making blanks of the character set forth, the combination with a bed on which the assembled blank material is positioned, of a traveling carrier, intermittently-operating staple-drivers on the carrier, means for moving the carrier intermittently in one direction, its movements alternating with the staple-driving operations of the staple-drivers, means for arresting the operations of the staple-drivers means for moving the carrier-frame continuously in the opposite direction and operating means for the staple-drivers.

5. In a machine for making blanks of the character set forth, the combination with a bed on which the assembled blank material is positioned, of a carrier-frame on the bed, intermittently-operating tacking devices on the carrier, means for moving the carrier in one direction to cross the positioned blank material while the tacking devices are in operation, means for stopping the operations of the tacking devices, means for reversing the movement of the carrier, on completion of a blank, to discharge the blank and operating means for the tacking devices.

6. In a machine for making blanks of the character set forth, the combination with a bed on which the assembled blank material is positioned, of a carrier-frame on the bed, intermittently-operating stapling devices on the carrier; means for moving the carrier in one direction to cross the positioned blank material while the stapling devices are in [fols. 1643 & 1644] operation, means for stopping the operations of the stapling devices means for reversing the movement of the carrier on completion of a blank to discharge the blank, means upon the carrier operating in the final movement thereof during the stapling operations to engage assembled material for another blank to draw the same into the machine while discharging the finished blank and operating means for the staple-drivers.

7. In a machine for making blanks of the character set forth, the combination with a bed on which the assembled blank material is positioned, of a traveling-carrier frame

movable along the bed to cross the positioned blank material, a motor, a drive-wheel on the carrier-frame driven by the motor, tacking devices on the carrier-frame, intermittent operating mechanism for the tacking devices and intermittent operating mechanism for moving the carrier in one direction, means for throwing said intermittent mechanisms simultaneously into and out of operative engagement with said drive-wheel, mechanism for reversing the movement of the carrier and means for automatically throwing said reversing mechanism into operative engagement with said drive-wheel as the said intermittent mechanisms are disengaged therefrom, substantially as described.

8. In a machine for making box-blanks, the combination with the bed-frame of the machine adapted to hold the material for one blank, of a traveling carrier on the frame, mechanism for moving the carrier at one speed intermittently across the blank material toward the receiving end of the machine, intermittently-actuated staple-drivers on the carrier alternating in their staple-driving operations with the intermittently-operating carrier-moving mechanism, means for reversing the movement of the carrier and causing it to travel at increased speed toward the discharge end of the bed-frame, and blank-material-engaging means on the carrier operating to engage the material for a new blank and draw it into the machine while discharging a finished blank.

Richard G. Inwood, Perry C. Lavenberg.

In presence of J. H. Landes, F. M. Wirtz.

(Here follow side folios 1645-1656.)

1645-1646

No. 815,197 PATENTED MAR. 13, 1906.

J. J. MILLER.

MACHINE FOR USE IN MAKING METAL BOUND PACKAGES.

APPLICATION FILED NOV. 18, 1904.

6 SHEETS—SHEET 1.

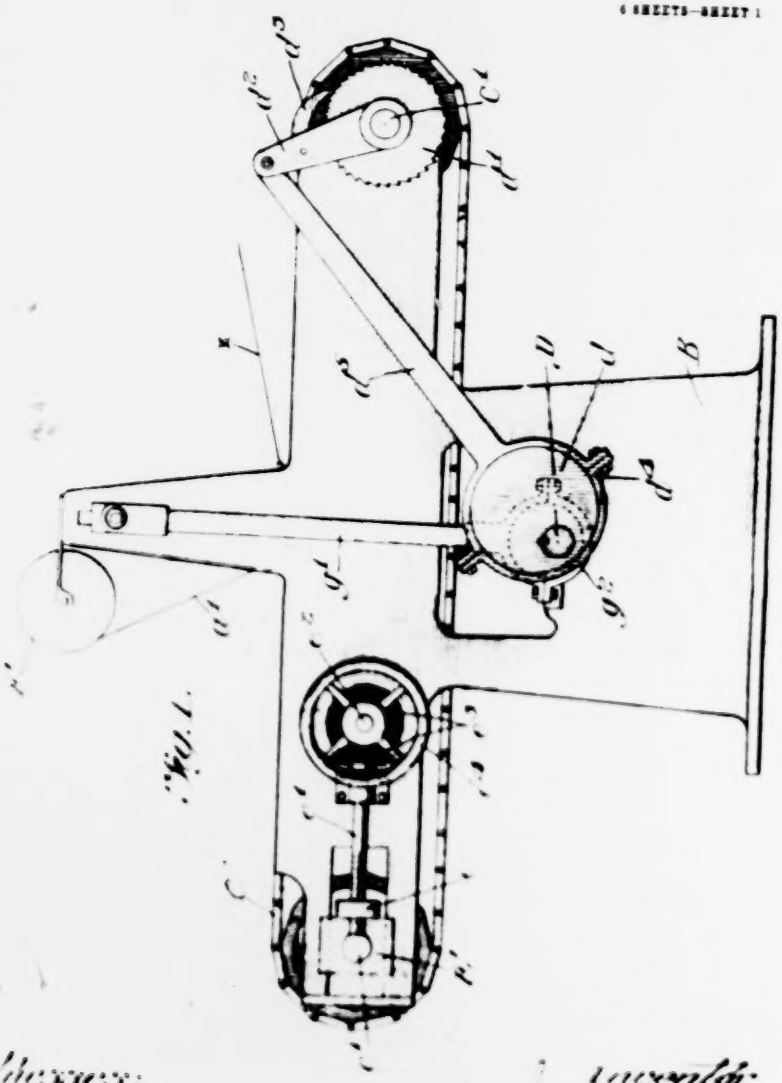


Fig. 1.

Witnesses:

Inventor:
James J. Miller
By Bakewell & Durand
Attys.

1647-1648

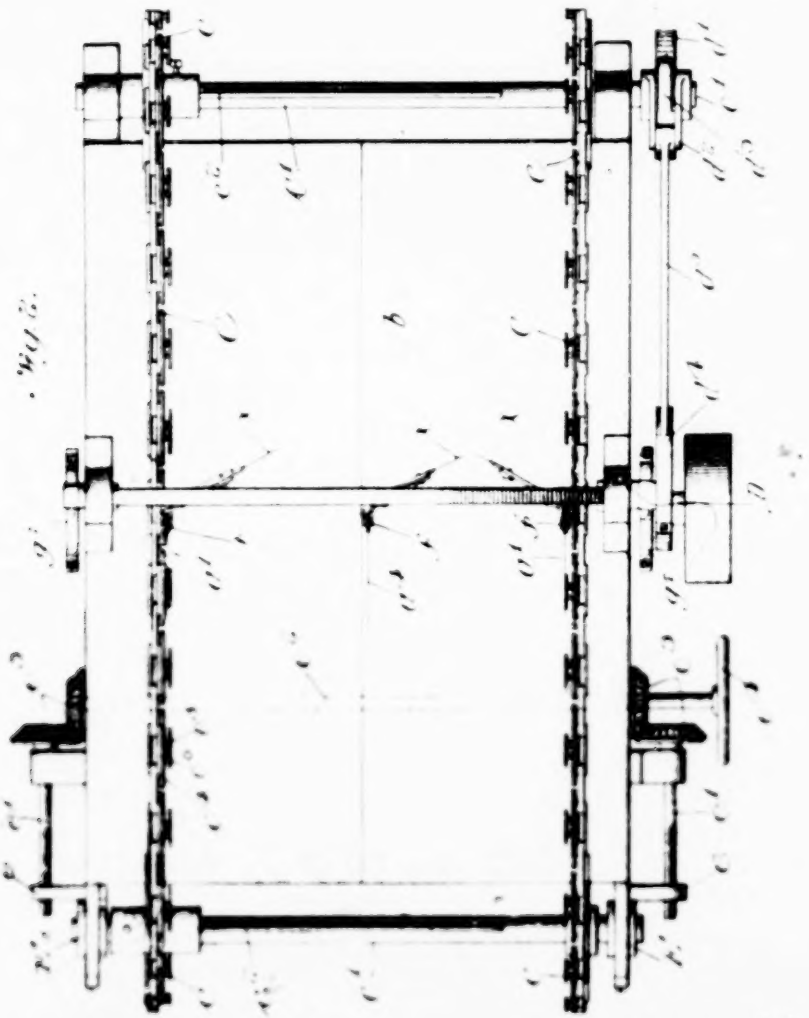
No. 815,197. PATENTED MAR. 13, 1906.

J. J. MILLER.

MACHINE FOR USE IN MAKING METAL BOUND PACKAGES.

APPLICATION FILED NOV. 16, 1904.

6 SHEETS—SHEET 2.



Witnesses:

Inventor:
Julius J. Miller
By Bakewell & Durand
Atty's.

1649-1650

No. 815,197. PATENTED MAR. 13, 1906.

J. J. MILLER.

MACHINE FOR USE IN MAKING METAL BOUND PACKAGES.

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6 SHEETS—SHEET 3.

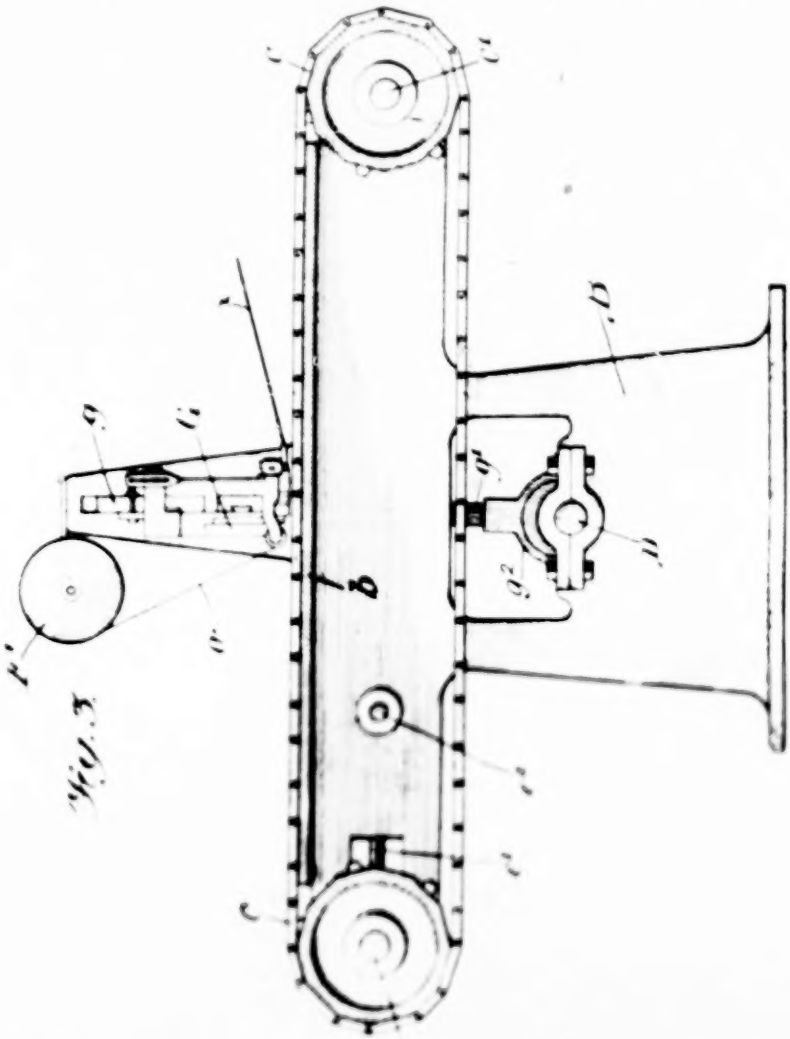


Fig. 3.

Witnesses:
J. Bullen
Robert F. Burns

Inventor:
Julius J. Miller
By Bakewell & Church
Atty.

1651-1652

No. 815,197. PATENTED MAR. 13, 1906

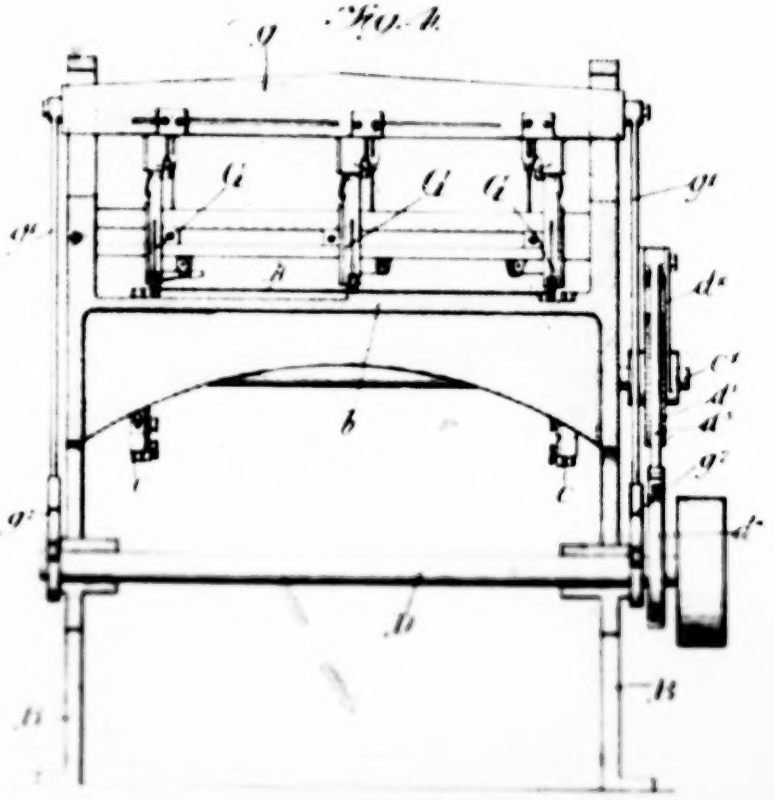
J. J. MILLER.

MACHINE FOR USE IN MAKING METAL BOUND PACKAGES.

APPLICATION FILED NOV. 18, 1904.

4 SHEETS—SHEET 4.

Fig. 4.



Witnesses
[illegible]
Robert Miller

Inventor.
Julius J. Miller
By Bailey & Barnard
Atty.

1653-1654

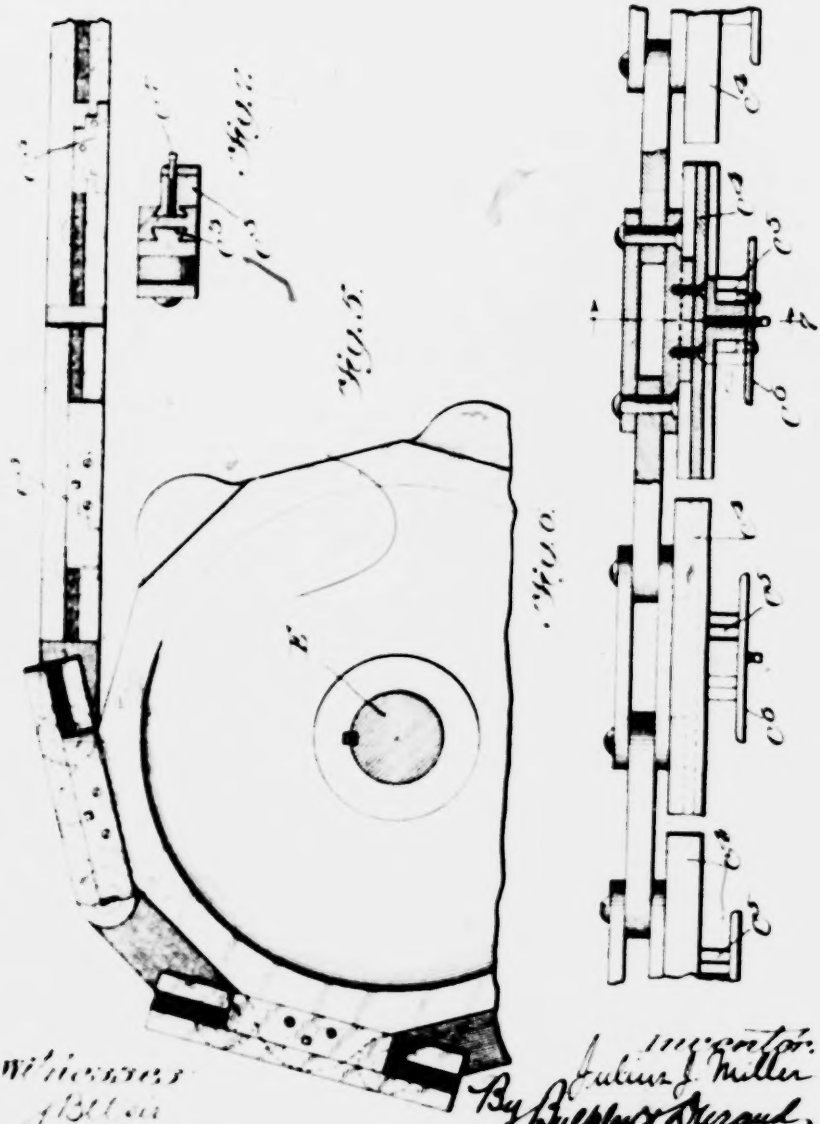
No. 815,197. PATENTED MAR. 13, 1906.

J. J. MILLER.

MACHINE FOR USE IN MAKING METAL BOUND PACKAGES.

APPLICATION FILED NOV 16, 1904

9 SHEETS—SHEET 5



Witnesses
[illegible]
Robert Miller

Inventor:
Julius J. Miller
By Bellinger & Durand
Attys

No. 815,197. PATENTED MAR. 13, 1906.

J. J. MILLER.

MACHINE FOR USE IN MAKING METAL BOUND PACKAGES.

APPLICATION FILED NOV. 16, 1904.

6 SHEETS—SHEET 6

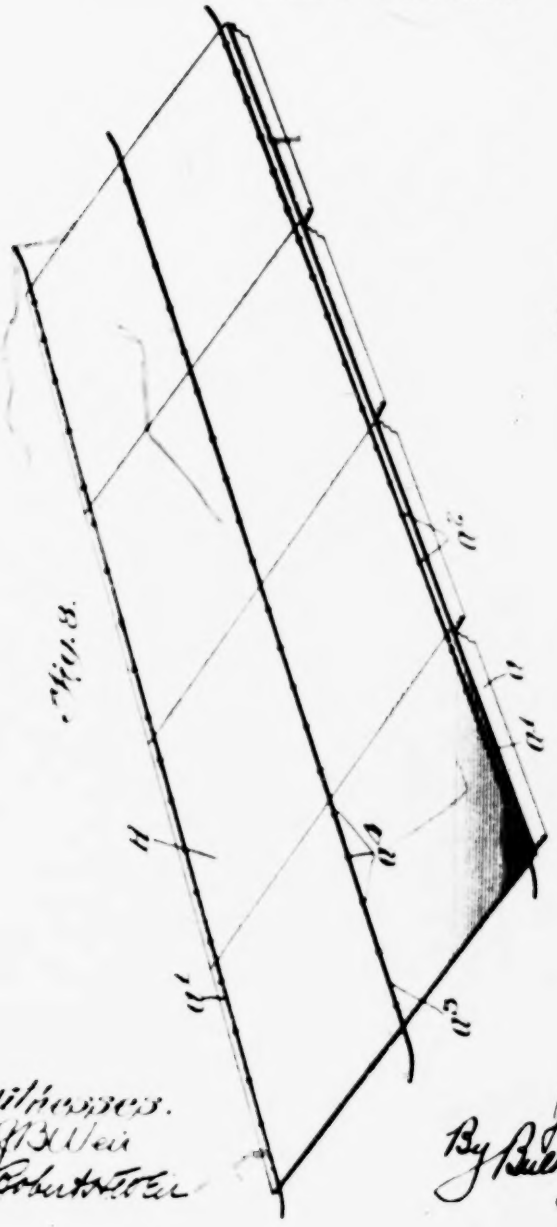


Fig. 9.

Witnesses.

Inventor:
Julius J. Miller
By Bakewell & Morsell
Atty

[Ed. 1657] United States Patent Office

Julius J. Muller, of St. Joseph, Michigan, Assignor to William P. Healy, of Chicago, Illinois.

Machine for Use in Making Metal-bound Packages

No. 815,197. Specification of Letters Patent. Patented March 13, 1906.

Application filed November 18, 1904. Serial No. 233,274.

To all whom it may concern:

Be it known that I, Julius J. Muller, a citizen of the United States of America, and a resident of St. Joseph, Berrien county, Michigan, have invented a certain new and useful Improvement in Machine for Use in Making Metal-Bound Packages, of which the following is a specification.

My invention relates to machines for use in making metal-bound packages of that particular character in which the side or end of the package is formed from a blank having its edge portions provided with cleats and reinforced by paper lengths of a greater or less width than the cleats.

Generally stated, the object of my invention is to provide an improved and highly efficient machine for making said blanks, and a further object is to provide an improved construction and arrangement whereby the machine may be employed for making blanks of different sizes, and a further object is to provide improved means for supporting the cleats and the balance of the blank and for guiding the cleats and the metallic backing and the balance of the blank a proper feeding movement in a direction lengthwise of the said cleats, and another object is to provide an improved construction and arrangement of such character that the blanks can be made rapidly and one after the other and, if desired, simultaneously or practically simultaneously without stopping the machine, and it is also an object, of course, to provide certain details and features of improvement tending to increase the general efficiency and serviceability of a machine of this particular character.

To the foregoing and other useful ends my invention consists in matters hereinafter set forth and claimed.

In the accompanying drawings, Figure 1 is a side elevation of a machine embodying the principles of my inven-

be received and held by the cleat holders and that the machine can be employed for making blanks of different lengths.

As shown in Fig. 4, the staples or other fastening devices can be inserted entirely through the blank and their ends clenched upon the upper surface of the table *b* or upon suitable anvils mounted on said table. It will be seen that an intermittent feeding movement is desirable for the work-holder that is composed of two endless traveling cleat supports—that is to say, providing the means for driving the staples or other fastening devices do not have any movement along with the work. For this purpose a driving shaft D is provided and mounted in bearings on each side of the machine. This shaft preferably extends below the link belts and is provided with an eccentric cam *d*. At the discharge end of the machine—that is to say, the end of the machine where the finished blank is thrown off or delivered—the shaft *c* is provided with a ratchet wheel *e*. Said shaft is also provided with a vibratory arm *f*, carrying a pawl *f'* adapted to engage the said ratchet *e*. The connecting-rod *g* is provided with a strap *g'*, connected to an arm or pitman *g''* with the vibratory arm *f*. With this arrangement it is evident that the rotation of the driving-shaft D results in an intermittent feeding movement on the part of the work-holder composed of the two parallel link belts or cleat-supports. In order that the said link belts or cleat-supports may be given the proper tension, the shaft *c'* at the receiving end of the machine can be mounted in sliding boxes or bearings *h*. These boxes or bearings are provided with rigid portions *i*, which serve as nuts and which are adapted to travel upon the threaded adjusting-screw *i'*. The transverse shaft or angular shaft *c''* is provided, together with bevel-gears *c'''*, as the means for simultaneously rotating the two adjusting-screws. To such end the shaft *c''* is provided with a hand-wheel *c''''*. By rotating the said hand-wheel it is obvious that the shaft *c'* will be given a lengthwise adjustment in the desired direction. In this way the link belts may have any suitable tension.

While the machine is operated the cleats are placed in the cleat-holder at the receiving end of the machine, and the sheets or strips of veneer are laid on top of the cleats.

of or other metallic binding are located immediately above the line of travel of the cleat holders having the supporting pieces or miter blocks c^2.

From the foregoing it will be seen that I provide endless traveling cleat supports in combination with means for directing wires or other metallic binding onto the upper surfaces of the blank and in combination with means for driving fastening devices into the blank for the purpose of securing the cleats and the metallic binding to opposite surfaces thereof. Consequently by my invention I provide a machine whereby metal bound box blanks provided at their edges with reinforcing cleats may be made with much greater certainty, facility, and rapidity than heretofore. Also, as explained, my machine has the further advantage of all adjustments necessary for the manufacture of blanks of different widths and lengths.

The link belts thus trained over guide-sprockets serve as guides to keep the endwise motion of the cleats direct—that is to say, they serve as guides for holding the cleats to straight lines of travel.

It will be seen that the chains are provided with means for holding the cleats—that is to say, with means adapted to hold the cleats against lateral displacement and to keep them in position to move endwise along straight lines extending below the staple drivers.

The endless traveling work-holder holds the cleats in parallel and fixed relation thereto, communicates the feeding motion through the cleats to the strengthening-wires or metallic binding, and guides the cleats while the same are subject to the drag or back pull of the strengthening-wires or metallic binding.

Preferably, as explained, the cleat-holders are secured to the inner sides of the link belts or cleat-supports and are adjustable longitudinally thereon, as well as readily removable therefrom. Each cleat-holder is provided with a block adapted to engage between the ends of the cleats and which is adjustable longitudinally of the cleat-holder with respect to cleats of different lengths. These blocks, which are preferably miter-blocks in character, are adapted [fol. 1660] not only to suitably separate the ends of the

cleats, but are also adapted to prevent the drag or back pull of the binding wires from causing endwise displacement of the cleats in the cleat-holders.

With further respect to the traveling work-holding means and to the capacity of the same to guide the cleats it will be seen that the pockets for the ends of the cleats have portions which engage both sides of the cleats to prevent lateral displacement of the same therefrom.

With further respect to the driving means—that is to say, the means for applying flexible connections between the ends of the cleats—it will be seen that said driving means are adapted and timed in their operations to bridge the flexible connections across the gaps or joints between the ends of the cleats, the work-feeding and staple-driving mechanisms being so relatively timed in their operations that staples are driven at each side of the said gaps or joints, thus leaving the flexible connections to serve as hinges between the different sections of the blank. It is obvious, however, that any other suitable known or approved connections can be applied between the ends of the cleats for the purpose of connecting together the different sections of the blank. In addition, it is also obvious that the link belts provided with pockets can be employed as cleat carrying and guiding devices for use in making cleat-reinforced articles of many different kinds and shapes.

What I claim as my invention is—

1. A machine for making wire-bound and cleat-reinforced box-blanks, comprising means for guiding the metallic binding onto the blank, means for inserting fastening devices to secure the metallic binding to the blank, an endless traveling work-holder adapted to support the work, and a power-operated feeding device connected with the said work-holder, the said work-holder having parallel side portions adapted to support and hold the cleats of the blank in parallel relation thereto, and against lateral displacement therefrom, and having means for preventing the drag or back pull of the binding from causing endwise displacement of the cleats, the said side portions of the endless work-holder being held, at least for a suitable portion of their path of travel, to a direct motion and thereby con-

stituting guides for holding the cleats to straight lines of travel.

2. A machine for making wire-bound and cleat-reinforced box-blanks, comprising means for guiding the metallic binding onto the blank, means for inserting fastening devices to secure the metallic binding to the blank, a power-operated feeding device, and an endless traveling work-holder actuated by said feeding device and having parallel side portions adapted to receive and hold the cleats end to end, in two parallel longitudinal rows, and having means for preventing the drag or back pull of the binding from causing endwise displacement of the cleats, said side portions of the endless work-holder being held, at least for a suitable portion of their path of travel, to a direct motion and thereby constituting guides for holding the cleats to straight lines of endwise or longitudinal travel, the means on the work-holder for receiving said cleats being adapted to hold the same against lateral displacement therefrom.

3. A machine for making wire-bound and cleat-reinforced box-blanks, comprising means for guiding the metallic binding onto the blank, means for inserting fastening devices to secure the metallic binding and cleats to the opposite surfaces of the blank, a power-operated feeding device, and a work-holder composed of a plurality of link belts suitably connected with said feeding device, said link belts being provided with means for receiving and holding the said cleats in positions lengthwise of the work-holder, constituting guides for holding the cleats to straight lines of endwise or longitudinal travel, and having means for preventing the drag or back pull of the binding from causing endwise displacement of the cleats, the said endless work-holder being held, at least or a suitable portion of its path of travel, to a direct motion in order to insure the proper extent of endwise or straight longitudinal movement of the cleats, the traveling work-holding and cleat-guiding means thus provided including portions which engage both sides of the cleats to prevent lateral displacement of the same therefrom.

4. A machine for making wire-bound and cleat-reinforced box-blanks, comprising means for guiding the me-

tallic binding onto the blank, means for inserting fastening devices to secure the metallic binding to the blank, a feeding device, and an endless traveling work-holder comprising a plurality of parallel link belts connected with said feeding device, said belts being provided at their inner sides with means for receiving and holding the cleats of the blank in positions lengthwise of the work-holder, constituting guides for holding the cleats to straight lines of endwise travel, and having means for preventing the drag or back pull of the binding from causing endwise displacement of the cleats, the endless work-holder being held, at least for a suitable portion of its path of travel, to a direct motion in order to insure the proper extent of endwise or straight longitudinal movement of the cleats, the traveling work-holding and cleat-guiding means thus provided including portions which engage both sides of the cleats to prevent lateral displacement of the same therefrom.

5. A machine for making wire-bound and cleat-rein- [fol. 1661] forced box-blanks, comprising means for guiding the metallic binding onto the blank, a plurality of endless traveling cleat-supports each adapted to hold the cleats end to end, in longitudinal rows, means for inserting fastening devices to secure the cleats and metallic binding to the blank, and means for operating said endless traveling cleat-supports, said cleat-supports constituting guides for keeping the endwise motion of the cleats direct, the means on the cleat-supports for receiving said cleats being adapted to hold the same against lateral displacement therefrom, and having means for preventing the drag or back pull of the binding from causing endwise displacement of the cleats, the endless cleat-supports being held, at least for a suitable portion of their path of travel, to a direct motion in order to insure the proper extent of endwise or straight longitudinal movement of the cleats.

6. A machine for making wire-bound and cleat-reinforced box-blanks, comprising a plurality of parallel link belts provided with means for receiving and holding said cleats, said link belts being also provided with blocks adapted to engage the ends of said cleats, and thereby prevent the drag or back pull of the binding from causing endwise displace-

ment of the cleats, the blocks being adjustable toward and away from each other to accommodate cleats of different lengths, means for guiding the metallic binding onto the blank, means for inserting fastening devices to secure the metallic binding lengthwise of said cleats, and means for operating the said link belts and thereby communicating motion to the blank in a direction lengthwise of said cleats and metallic binding, said link belts also constituting guides for keeping the endwise motion of the cleats direct, the means on the work holder for receiving said cleats being adapted to hold the same against lateral displacement therefrom, and the endless workholder being held, at least for a suitable portion of its path of travel, to a direct motion in order to insure the proper extent of endwise or straight longitudinal movement of the cleats.

7. A machine for making wire bound and cleat reinforced box blanks, comprising a plurality of endless traveling cleat supports, said cleat supports being adapted to hold the cleats longitudinally thereof, means for guiding the metallic binding onto the blank, means for inserting fastening devices to secure the metallic binding lengthwise of said cleats, together with means for operating said cleat supports, the said cleat supports constituting guides for keeping the endwise motion of the cleats direct, and being relatively adjustable toward and away from each other with respect to the making of blanks of different widths, the means on the cleat supports for receiving said cleats being adapted to hold the same against lateral displacement therefrom, and having means for preventing the drag or back pull of the binding from causing endwise displacement of the cleats, and the endless cleat-supports being held, at least for a suitable portion of their path of travel, to a direct motion in order to insure the proper extent of endwise or straight longitudinal movement of the cleats.

8. A machine for making wire-bound and cleat-reinforced box-blanks, comprising means for feeding the metallic binding, means for inserting fastening devices to secure the cleats and binding to the blank, a pair of endless traveling link belts provided with means for receiving and holding the said cleats end to end, in two parallel rows, and con-

stituting guides for holding the cleats to straight lines of travel, said link belts being relatively adjustable toward and away from each other and adapted to support and carry the blank bodily in a direction lengthwise of said cleats and metallic binding, the means on the link belts for receiving said cleats being adapted to hold the same against lateral displacement therefrom, and having means for preventing the drag or back pull of the binding from causing endwise displacement of the cleats, and the endless link belts being held, at least for a suitable portion of their path of travel, to a direct motion in order to insure the proper extent of endwise or straight longitudinal movement of the cleats.

9. A machine for making wire-bound and cleat-reinforced box-blanks, comprising an endless traveling link belt provided with cleat-holders adapted to hold the cleats parallel with said belt, and communicate motion to the blank in a direction lengthwise of said cleats and metallic binding, said link belt also constituting a guide for keeping the endwise motion of the cleats direct, together with means for inserting fastening devices to secure the metallic binding lengthwise of the cleats, guiding devices for directing the metallic binding onto the blank as the latter moves along, and spacing-blocks secured to said cleat-holders and adapted to prevent the drag or back pull of the binding from causing endwise displacement of the cleats, the endless link belt being held, at least for a suitable portion of its path of travel, to a direct motion in order to insure the proper extent of endwise or straight longitudinal movement of the cleats, the traveling work-holding and cleat-guiding means thus provided including portions which engage both sides of the cleats to prevent lateral displacement of the same therefrom.

10. A machine for making wire-bound and cleat-reinforced box-blanks, comprising a plurality of parallel and endless traveling cleat-supports adapted to support and carry the blank forward in a direction lengthwise of the said cleats and metallic binding, and constituting guides for holding the cleats to straight lines of endwise travel, [fol. 1662] said cleat-supports being relatively adjustable toward and away from each other with respect to the mak-

ing of blanks of different widths, and the said cleat supports being provided with spacing blocks which engage the ends of the cleats, and which are adjustable lengthwise of the said cleat supports with respect to blanks of different lengths, together with means for guiding the metallic binding onto the blank as the latter moves along, means for inserting fastening devices to secure the metallic binding to the blank, and suitable means for operating said cleat supports, the said blocks being adapted to prevent the drag or back pull of the binding from causing endwise displacement of the cleats, and the endless cleat supports being held, at least for a suitable portion of their path of travel, to a direct motion in order to insure the endwise or straight longitudinal movement of the cleats, the traveling work-holding and cleat-guiding means thus provided including portions which engage both sides of the cleats to prevent lateral displacement of the same therefrom.

11. A machine for making wire-bound and cleat-reinforced box blanks, comprising guides for the cleats, said guides comprising parallel endless traveling members adapted to hold the cleats to straight lines of travel, intermittent feed mechanism for advancing the cleats longitudinally with their guides and with a sheet through the machine, an intermittingly actuated staple-driver adjacent the path of each cleat, alternating in its action with said feed mechanism, to fasten the sheet, by successive operations, to the cleat, and means for guiding strengthening-wires with the cleats and sheet across the staple-drivers, the means on the endless traveling members for receiving said cleats being adapted to hold the cleats in parallel relation thereto, and having means for preventing the drag or back pull of the binding from causing endwise displacement of the cleats, and the endless traveling members being held, at least for a suitable portion of their path of travel, to a direct motion in order to insure the proper extent of endwise or straight longitudinal movement of the cleats, the traveling work-holding and cleat-guiding means thus provided including portions which engage both sides of the cleats to prevent lateral displacement of the same therefrom.

12. A machine for making wire-bound and cleat-reinforced box-blanks, comprising intermittingly actuated staple-drivers, guides for the cleats, said guides comprising parallel endless traveling members adapted to hold the cleats to straight lines of travel, intermittent feed mechanism for advancing the cleats longitudinally with their guides and with a sheet through the machine, an intermittingly-actuated staple-driver and a guide for a strengthening-wire adjacent the path of each cleat, the staple-drivers alternating in their action with the said feed mechanism to fasten the strengthening-wires and sheet, by successive operations, to the cleats at intervals in the direction longitudinally of the cleats, the means on the endless traveling members for receiving said cleats being adapted to hold the cleats in parallel relation thereto, and having means for preventing the drag or back pull of the binding from causing endwise displacement of the cleats, and the endless traveling members being held, at least for a suitable portion of their path of travel, to a direct motion in order to insure the proper extent of endwise or straight longitudinal movement of the cleats, the traveling work-holding and cleat-guiding means thus provided including portions which engage both sides of the cleats to prevent lateral displacement of the same therefrom.

13. A machine for making wire-bound and cleat-reinforced box-blanks, comprising intermittingly-actuated staple-drivers, guides for the cleats, said guides comprising parallel endless traveling members adapted to hold the cleats to straight lines of travel, guides for the strengthening-wires, and intermittingly-actuated feed devices for advancing the sheets and strengthening-wires and cleats and guides longitudinally below the said staple-drivers, the said feed devices alternating in their action with the said staple-drivers, the means on the endless traveling members for receiving said cleats being adapted to hold the cleats in parallel relation thereto, and having means for preventing the drag or back pull of the binding from causing endwise displacement of the cleats, and the endless traveling members being held, at least for a suitable portion of their path of travel, to a direct motion in order to insure the proper extent of endwise or straight longitudinal move-

15. A machine for making wire-bound and cleat-reinforced box-blanks, comprising means for guiding the binding-wires onto the blank, means for driving staples to secure the cleats and binding-wires to the blank, a plurality of endless link belts, cleat-holders removably secured to the inner side of each belt, each cleat-holder being adjustable longitudinally of its belt and a block secured to and longitudinally adjustable of each cleat-holder, said blocks being adapted to engage and separate the ends of the cleats and prevent endwise displacement thereof by

the drag or back pull of the binding-wires, the traveling work-holding and cleat-guiding means thus provided including portions which engage both sides of the cleats to prevent lateral displacement of the same therefrom.

18. A machine for making wire-bound and cleat-reinforced box-blanks, comprising means for guiding the binding-wires onto the blank, means for driving staples to secure the cleats and binding-wires to the blank, a plurality of endless link belts, cleat-holders removably secured to the side of each belt, each cleat-holder being adjustable longitudinally of its belt, and a block secured to and longitudinally adjustable on each cleat-holder, said blocks being adapted to engage and separate the ends of the cleats and prevent endwise displacement thereof by the drag or back pull of the binding-wires, the traveling work-holding and cleat-guiding means thus provided including portions which engage both sides of the cleats to prevent lateral displacement of the same therefrom.

17. In a machine of the character specified, a link belt adapted to carry and guide a plurality of cleats held end to end, and provided with members for spacing the cleats apart endwise, and means for operating said link belt.

18. In a machine of the character specified, a plurality of link belts adapted to carry and guide a plurality of cleats held end to end in parallel and longitudinally moving rows, and provided with means for spacing the cleats apart endwise, and means for operating said link belts.

19. In a machine of the character specified, means for supplying binding wires, mechanism for securing the binding wires to the cleats, and a combined endless traveling work-support and cleat-guide and binding-wire puller, the latter having means for engaging both sides of the longitudinally-disposed parallel rows of cleats, thereby holding and guiding the cleats endwise, and having also means for preventing endwise displacement of the cleats by the back pull of the binding-wires.

20. In a machine of the character described, an endless traveling cleat-guide provided with portions adapted to engage both sides of the longitudinally-disposed cleats and

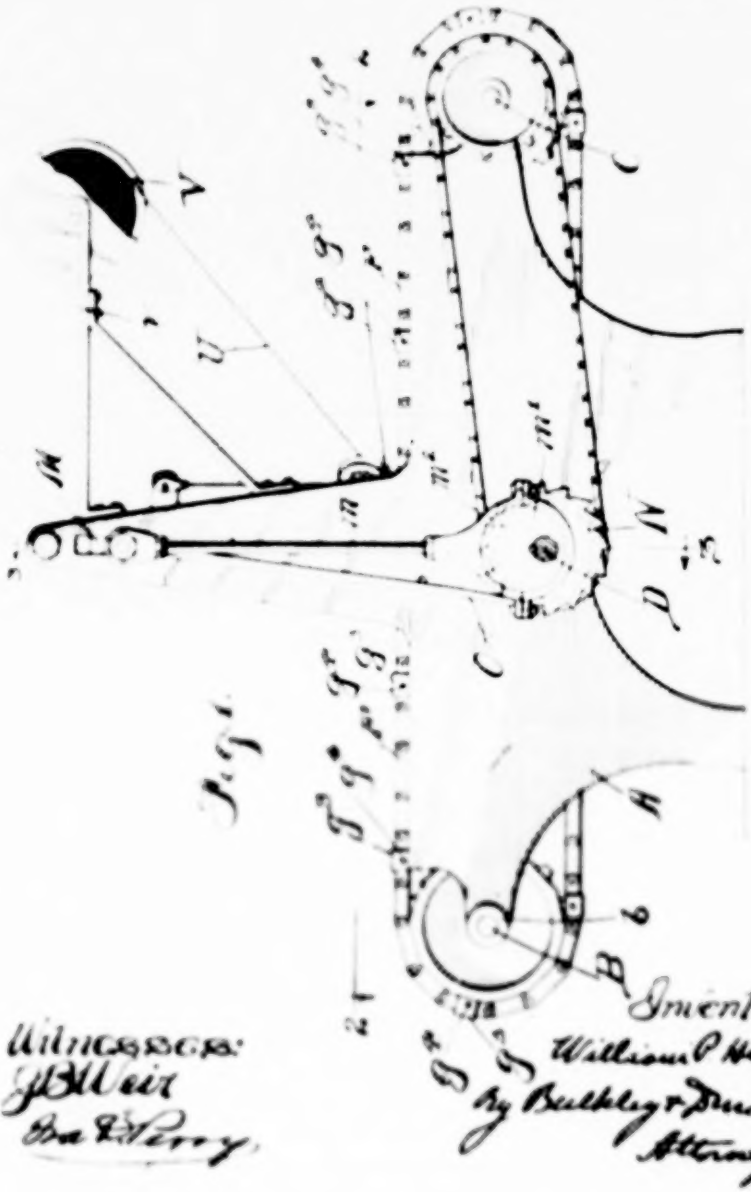
(Here follow side folios 1665-1678.)

1666-1666

PATENTED JULY 31, 1900

W. P. HEALY

MACHINE FOR MAKING WIRE BOUND BOX BLANKS



Witnesses:
J. B. Weir
Chas. E. Perry.

Inventor
William P. Healy
by Bakewell & Duncan
Attorneys

1667-1668

No. 827,097. PATENTED JULY 31, 1906.

W. P. HEALY.

MACHINE FOR MAKING WIRE BOUND BOX BLANKS.

APPLICATION FILED JUNE 3, 1905.

7 SHEETS—SHEET 2.

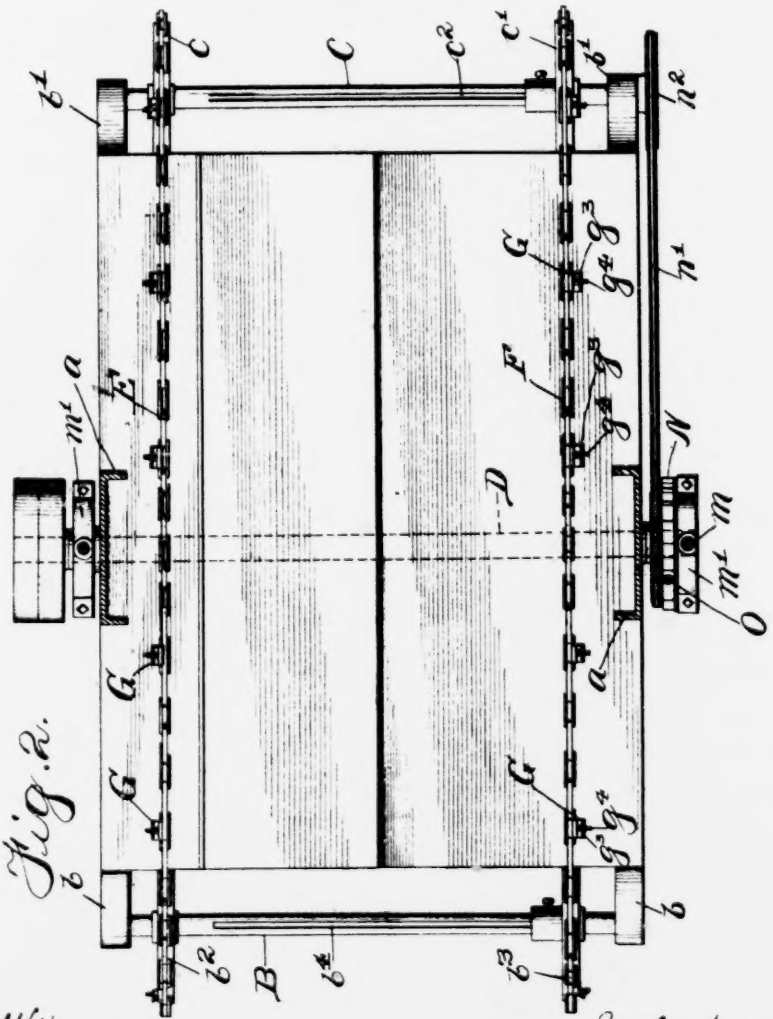


Fig. 2.

Witnesses:
J. B. Weir
Jas. A. Kenny

Inventor:
William P. Healy
By Bulkley & Bulkley
Attorneys

No. 827,097. PATENTED JULY 31, 1906.

W. P. HEALY.

MACHINE FOR MAKING WIRE BOUND BOX BLANKS.

APPLICATION FILED JUNE 3, 1905.

7 SHEETS—SHEET 3.

Fig. 3.

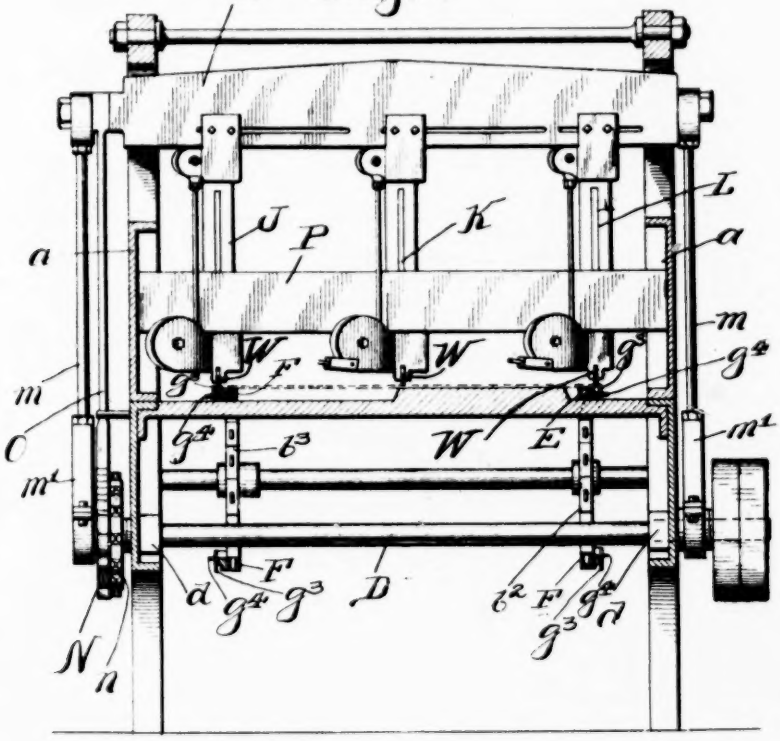


Fig. 4.

Witnesses:
J. B. Weir
Geo. L. Berry

Inventor:
William P. Healy
By Bakewell & Durand
Attorneys

No. 827,097

1671-1672

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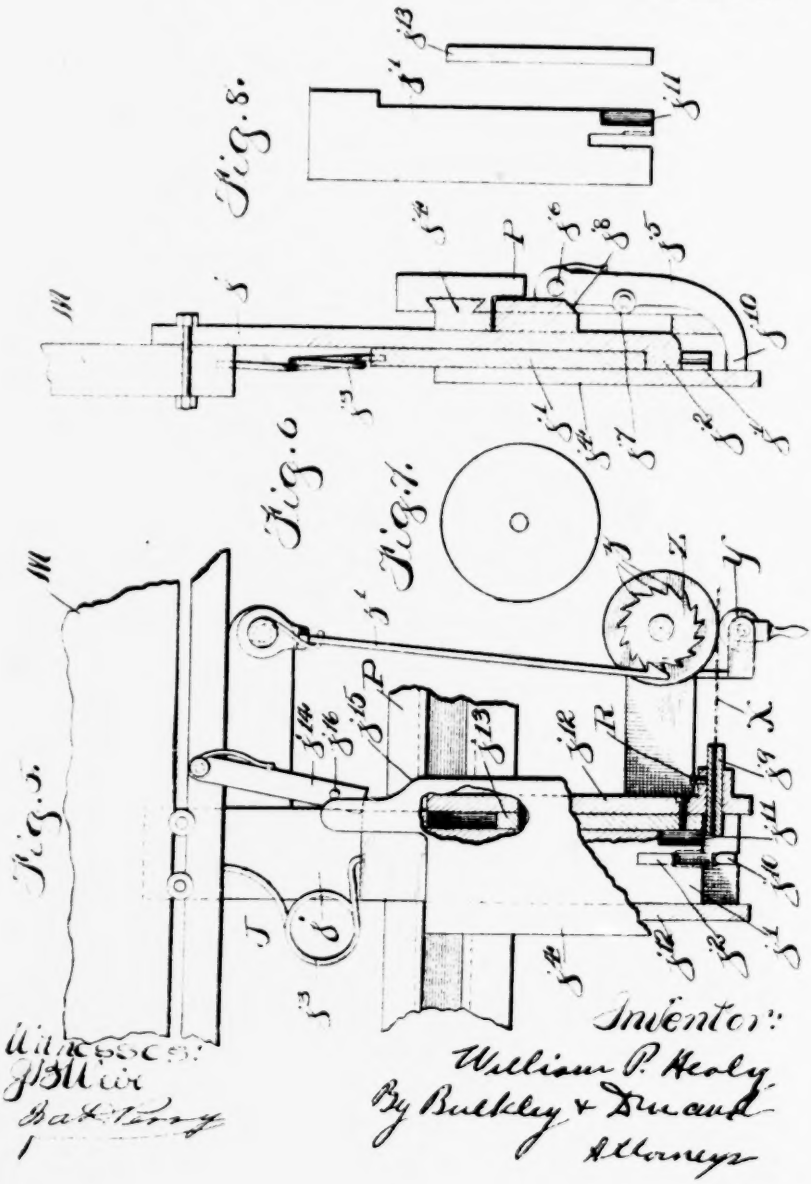
W. P. HEALY.

MACHINE FOR MAKING WIRE BOUND BOX BLANKS.

APPLICATION FILED JUNE 5, 1905.

7 SHEETS—SHEET 4.



No. 827,097. PATENTED JULY 31, 1906.

W. P. HEALY.

MACHINE FOR MAKING WIRE BOUND BOX BLANKS.

APPLICATION FILED JUNE 3, 1905

7 SHEETS—SHEET 5

Fig. 10.

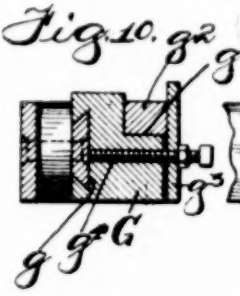


Fig. 9.

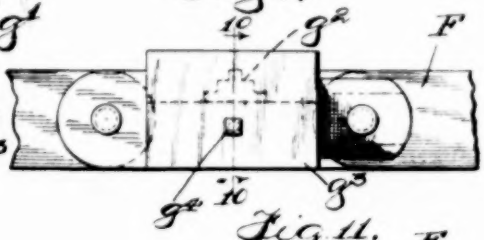


Fig. 11.

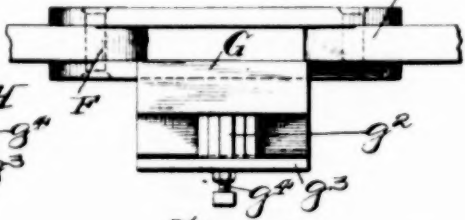


Fig. 12.

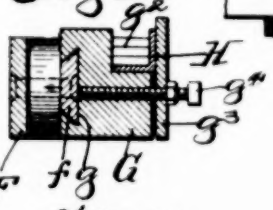


Fig. 14.

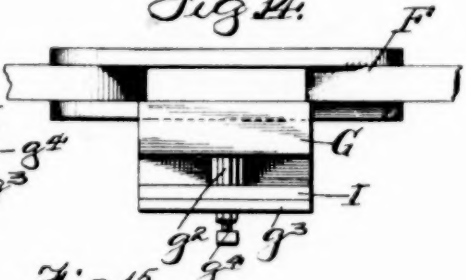


Fig. 13.

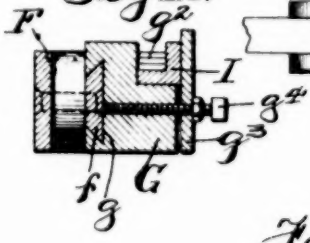


Fig. 15.

Fig. 16.

Witnesses:
J. B. Weir
Jno. D. Berry

Inventor:
William P. Healy
By Bakewell & Briand.
Attorneys.

No. 827,097. PATENTED JULY 31, 1906.

W. P. HEALY.

MACHINE FOR MAKING WIRE BOUND BOX BLANKS.

APPLICATION FILED JUNE 3, 1905.

7 SHEETS—SHEET 6.

Fig. 17.

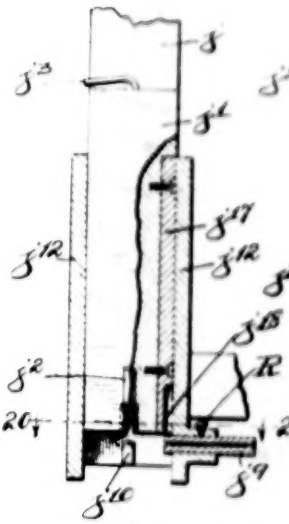


Fig. 18.

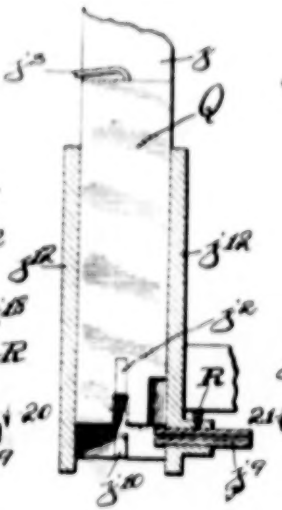


Fig. 19.

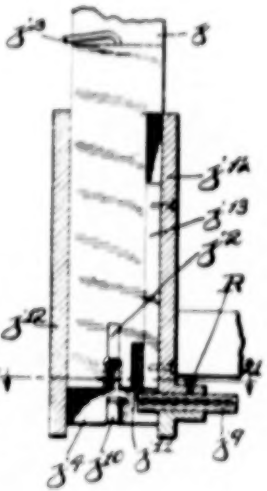


Fig. 20.

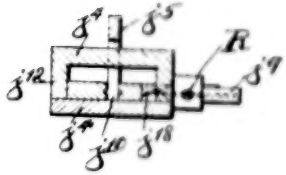


Fig. 21.

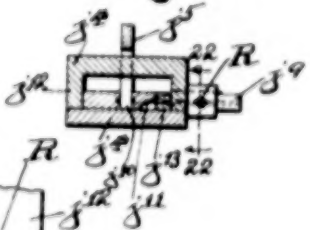


Fig. 22.

Witnesses:
J. B. Weir
Bad. Berry

Inventor:
William P. Healy
By Dulley & Donald
Attorneys

1677-1678

No. 827,097. PATENTED JULY 31, 1906.

W. P. HEALY.

MACHINE FOR MAKING WIRE BOUND BOX BLANKS.

APPLICATION FILED JUNE 2, 1905.

7 SHEETS—SHEET 7.

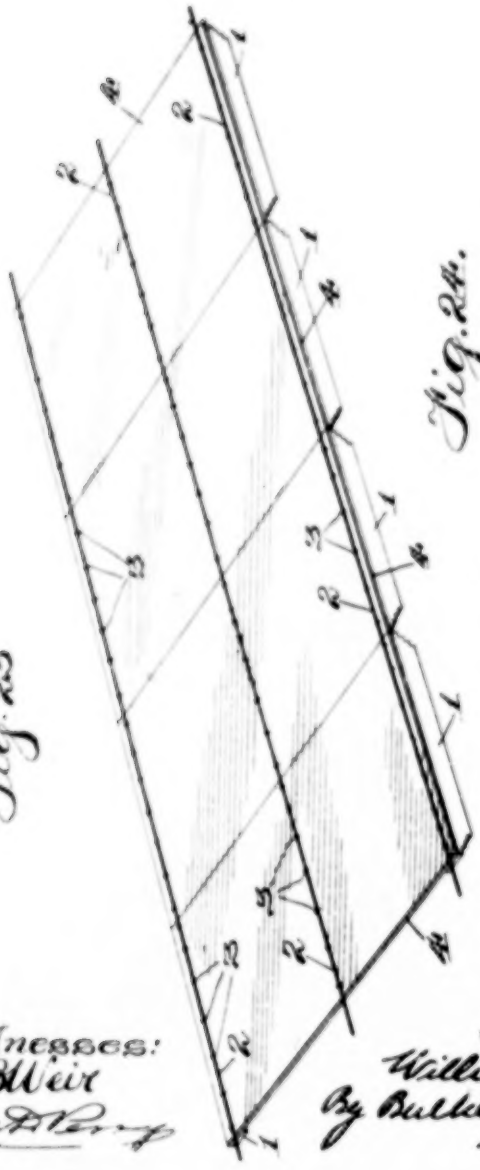


Fig. 23.

Fig. 24.

Witnesses:
J. B. Weir
[illegible]

Inventor:
William P. Healy
By Bakewell & Dunbar
Attorneys

[fol. 1679] United States Patent Office

William P. Healy, of Chicago, Illinois

Machine for Making Wire-bound Box-blanks

No. 827,097. Specification of Letters Patent. Patented July 31, 1906

Application filed June 3, 1905. Serial No. 263,549

To all whom it may concern:

Be it known that I, William P. Healy, a citizen of the United States of America, and a resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Machines for Making Wire-bound Box-Blanks, of which the following is a specification.

My invention relates to machinery for use in manufacturing metal-bound packages—for example, the well-known wire-bound packing-boxes—and particularly to machinery for making the wire-bound blanks from which the sides of the said boxes are made, these blanks each consisting of suitable strips of veneering held together by the parallel binding-wires on the outer surface of the blank and having reinforcing-cleats which are secured end to end to the inner surface of the blank along the outer edges thereof.

Generally stated, the object of my invention is the provision of an improved and highly efficient machine for making wire-bound box-blanks of the foregoing general character.

Special objects of my invention are to provide an improved construction and arrangement whereby the same machine may be employed for making box-blanks having cleats of different sizes; to provide an improved construction and arrangement whereby the same machine may be used for making box-blanks of different widths and lengths and having cleats of different widths and thicknesses; to provide an improved construction and arrangement whereby the same machine may be employed for driving staples of different lengths and for driving the staples at different distances apart, according to the width or thickness of the cleats and according to the width of the blank; to provide an improved construction and arrangement

whereby the traveling work-holder of a machine of this character may be readily adjusted or rearranged with respect to blanks of different sizes and with respect to blanks having cleats of different widths and thicknesses, so that the said work-holder may practically handle all of the different sizes and kinds of materials which enter into the manufacture of blanks of different weights and sizes—that is, with respect to the manufacture of wire-bound boxes of different sizes and for different purposes—and to provide certain details of construction and features of improvement tending to increase the general efficiency and serviceability of a wire-bound-box-blank-making machine of this particular character.

To the foregoing and other useful ends my invention consists in matters hereinafter set forth and claimed.

In the accompanying drawings, Figure 1 is a side elevation of a wire-bound-box-blank-making machine embodying the principles of my invention. Fig. 2 is a horizontal section on line 2 2 in Fig. 1. Fig. 3 is a vertical section on line 3 3 in Fig. 1. Fig. 4 is a detail perspective of one of the combined feed-tubes and knives involved in the construction of the stapling mechanism. Fig. 5 is a enlarged detail view more or less in section, showing my improved stapling mechanism. Fig. 6 is a vertical section of the mechanism shown in Fig. 5. Fig. 7 shows another size of feed-wheel—that is, a feed-wheel for feeding the wires from which the staples are made and which is interchangeable with the one shown in Fig. 5. Fig. 8 is a detail view of the staple-former shown in Figs. 5 and 6 and of the gib which is employed in conjunction with said staple-former. Fig. 9 is an enlarged side elevation of one of the cleat-carriers which are secured to the link belts or endless chains constituting the traveling work-holder. Fig. 10 is a vertical section on line 10 10 in Fig. 9. Fig. 11 is a plan of the device shown in Fig. 9. Fig. 12 is a view similar to Fig. 10, but showing one of the removable gibs for the work-holder, said gib being shown inserted in place in the cleat-carrier secured to the chain or link belt. Fig. 13 is a view similar to Fig. 12, but showing a thicker gib substituted for the one shown in Fig. 12, whereby the cleat-carrier may support a much narrower and thinner cleat. Fig. 14 is a plan of the device shown in Fig. 13. Fig. 15 is a perspective of the removable gib

shown in Fig. 13. Fig. 16 is a perspective of the removable gib shown in Fig. 12. Fig. 17 is similar to Fig. 5, but shows the staple-former with its side extension applied, so as to make the former wider and of a character to cut off and form and drive a long staple. Fig. 18 illustrates a staple-former of the same width as the staple-former and its extension shown in Fig. 17, this relatively wider staple-former shown in Fig. 18 being interchangeable with the staple-former shown in Fig. 5, whereby practically the same result is accomplished—that is to say, a result similar to that which is accomplished by putting on the staple-former ex-[fol. 1680] tension shown in Fig. 17. Fig. 19 is a view similar to Fig. 5, but showing the parts more in section. Fig. 20 is a horizontal section on line 20 20 in Fig. 17. Fig. 21 is a horizontal section on line 21 21 in Fig. 19. Fig. 22 is a section on line 22 22 in Fig. 21. Fig. 23 is a perspective of the completed blank. Fig. 24 is an end view of the wire-bound box-blanks shown in Fig. 23.

As thus illustrated, the particular type of machine in connection with which I have illustrated my invention comprises a suitable body-frame A, adapted to support the shafts and other operative parts in suitably-elevated positions. At one end of the said body-frame a transversely-arranged shaft B is supported in bearings b, while at the other end a transversely-arranged shaft C is supported in bearings b'. At a point between those two shafts a third or driving-shaft D is mounted in bearings d. The shaft B is provided with a pair of sprocket-wheels b^2 and b^3, the latter adapted to slide longitudinally of the shaft by reason of the provision of a spline or keyway b^4. In a similar manner the shaft C is provided with sprocket-wheels c and c', the latter being adapted to slide along the spline or keyway c^2, extending longitudinally in the said shaft. As shown, the sprockets b^2 and c are connected by a sprocket-chain or endless link belt E, while the sprocket-wheels b^3 and c' are connected by a similar chain or belt F. The cleat-carriers G are removably secured to the sides of said chains or endless link belts and are preferably of the construction shown more clearly in Figs. 9 to 14, inclusive. For example, the chain F may have its outside links finished off in a manner to give them a dovetail shape in cross-sec-

tion, as shown in Figs. 10, 12, and 13. In such case these outside links *f* are adapted to receive the cleat-carriers G, the latter having dovetail grooves *g*, adapted to fit the links *f*. These cleat-carriers are each provided with a seat or recess *g'* for the ends of the cleats I. (See Figs. 23 and 24.) Also each cleat-carrier is provided with a miter-block *g²*, removably held in place by a clamping-plate *g³*. The step-mitered ends of the cleats I are adapted to be properly separated by the blocks *g²*, it being understood that it is important that these cleats be separated sufficiently at their ends to insure the slight space that is desirable between the meeting edges of the different sections of which the completed blank is composed. The character of these miter-blocks and the consequent space between the different sections of the blank can be determined or regulated in accordance with the size of the boxes and according to the manner in which it is desired that the edge portion of one section be lapped upon the edge portion of another section when the blank is folded around the heads or end walls to which the cleats are secured in the final step involved in the general operation of making the box. Also it will be seen that these cleat-holders are removably secured to the chains by means of screws or bolts *g⁴*, which extend through the cleat-holders and bear against the outer surfaces of the chain-links, thereby producing a binding or clamping action when the said screws or bolts are tightened. Furthermore, the clamping-plates *g³* are tightened up upon the miter-blocks *g²* by means of nuts *g⁵*, screwed upon the outer end portions of the screws or bolts *g⁴*. With this arrangement of the cleat-holders are adapted to receive cleats of a definite width and thickness only, although the adjustability of the cleat-holders toward and away from each other makes it possible to use the machine in connection with cleats of different lengths. In order, therefore, that the same machine and the same cleat-holders of the said machine may be used in connection with cleats of different widths and thicknesses, I provide a suitable number of gibs—such, for example, as those shown in Figs. 15 and 16. As shown in Fig. 12, the gib H is L-shaped in cross-section and of a thickness to render the cleat-holder G, when the gib is applied as shown, suitable for use in connection with cleats which are both narrower and thinner than would be

the case were the gib not employed. In Fig. 13 the gib I is similar in form and shape to the gib H, but is somewhat thicker, and is thereby adapted to make the cleat-holder capable of receiving cleats which are considerably narrower and thinner than those which will fit the cleat-holders shown in Figs. 10 and 12. It will be understood, of course, that these gibs can be used either way—that is, their vertical flanges or walls can be arranged either at the inner or outer side of the cleat-holder; but as shown in the drawings these L-shaped gibs are arranged with their vertical walls or flanges next to the clamping-plates *g*. In this way the same machine and the same cleat-holders are made capable of receiving and holding cleats of different widths and thicknesses, as well as cleats of different lengths, and consequently the same machine can be used for making blanks of different widths and lengths and of different sizes generally. In other words, the same machine can be used in connection with different kinds of stock and for the purpose of manufacturing different kinds and sizes of wire-bound packing-boxes.

The binding-wires 2 are secured to the upper surface of the blank by staples 3, the staples for the outer wires being driven through the veneering 4 and into the cleats 1, so as to flexibly connect the four sections of the blank and secure the cleats to the under or inner surface thereof. Any suitable arrangement can be employed for forming and driving said staples; but as a matter of further and special improvement I provide staple forming and driving means [fol. 1681] of such character that the length of the staples can be changed or varied—that is, of such character that either long or short staples can be driven—according to the thickness of the cleats. Evidently longer staples are necessary or desirable in connection with comparatively thick cleats and thicker veneering than are necessary in connection with comparatively thin cleats and thinner veneering. As shown, the improved staple forming and driving means comprise three sets of mechanisms J, K, and L, the same being distributed in a transverse row above the top or bed of the machine and above the sprocket-chains or endless belts constituting the traveling work-holder of the machine. These stapling mechanisms are operated by a transversely-arranged vertically-reciprocating cross-head M, which latter is actuated in the proper and desired man-

ner by a pitman m, having its lower ends connected with eccentric straps m', mounted upon eccentric cams m^2, secured to the shaft D. Upon this same shaft there may be provided a ratchet-wheel N and a sprocket-wheel n, the latter being connected by a sprocket-chain n' with a sprocket-wheel n^2 on the outer end of the shaft C. The end of the cross-head M can be provided with a ratchet-pawl O, adapted to engage the teeth of the ratchet-wheel N, it being understood, of course, that the parts are so relatively formed and the operations so timed that the downward movement of the cross-head M first causes the pawl O to rotate the ratchet-wheel one step, thus giving the chains or link belts a single step forward. After this the further downward movement of the said cross-head produces no additional movement of the work-holding means, inasmuch as the pawl O slips off from the tooth which it was engaging and slides downward without producing any further rotary motion on the part of the shaft D; but this final or further downward movement on the part of the cross-head M is utilized in driving the staples, the work being held stationary while the staples are being driven. In this way the first part of the downward movement of the cross-head accomplishes the formation of the three staples and also of the feeding movement of the work supported by the traveling work-holder, and after this the remaining portion of the downward movement of the cross-head is utilized in simply inserting the three staples which have been formed from the wire fed to the three stapling mechanisms when the cross-head moves upward. The three stapling mechanisms or sets of staple forming and driving devices can all be alike, and a description of one will be sufficient. As illustrated, the stapling mechanism J consists of a staple-driver j, which is suitably secured to the cross-head M and adapted to be adjusted longitudinally of the latter with respect to the adjustment of the machine in accordance with the width of the blank. Also a suitable staple-former j' is provided, the latter having the usual bifurcated lower end portion adapted to straddle the lower end j^2 of the staple-driver. As usual, however, this staple-former is yieldingly connected with the cross-head M by means of a spring j^3 instead of being rigidly connected like the driver. Below the cross-head and secured to the vertical upright portions

a of the body-frame there is a transverse bar or supporting member P, to which is rigidly but adjustably secured the box or guiding structure j^3 of the stapling mechanism J. The loop-bar j^7 is pivotally mounted at j^8 and provided with a lower end portion adapted to project between the two prongs or lower end portions of the staple-former and adapted to serve as the means upon which the short length of wire is bent into the form of a staple. The pivotal mounting for the said loop-bar is carried by the box-like or guiding structure j^3, which latter is mounted for horizontal adjustment longitudinally of the bar or supporting member B. At a point intermediate of its end the said loop-bar is provided with a roll or projection j^9, adapted to be engaged by a cam j^{10}, carried by the staple-driver *j*. The wire X, from which the staples are made, is fed through an adjustable tube j^{11} and in a direction to pass horizontally just above and on top of the lower end portion j^{12} of the said loop-bar. This tube is preferably beveled at its inner end, so as to correspond with the bevel j^{13} on the lower end of the staple-former, the edges of these two beveled surfaces constituting co-operating knife-edges for severing the wire after it has been pushed or fed across the loop-bar. The recess or space between one side of the staple-former and the stationary wall j^{12} is filled by a stationary gib j^{15}, which latter is secured to the said wall. As shown, the cross-head M may be provided with a spring-pressed finger j^{14}, having its lower end portion adapted normally to engage the upper end of the staple-former. The rigid structure j^3 is provided with a stationary cam j^{16}, adapted to engage a pin j^{17}, carried by the finger j^{14}. When the cross-head M starts to move in a downward direction, the finger j^{14} serves to lock the staple-former against movement relatively to the said cross-head until such time as the pin j^{17} engages the cam or bevel portion j^{16}. After this and as soon as the staple-former engages the veneering of the blank the cam j^{16} throws the finger j^{14} out of engagement with the upper end of the staple-former, thereby permitting the latter to remain stationary while the cross-head M completes its downward movement. The staple-driver of course remains rigidly connected with the cross-head and moves in unison with the latter, and in this way the staple-driver presses or drives the staple into the work

[fol. 1682] during the time that the staple-former remains stationary; but at such time the staple-former serves as a guide to support the side portions of the staple to prevent buckling while the same is being driven into the wood. In other words, the staple-former moves downwardly in unison with the head M to the extent to cut off and bend the short length of wire over the loop-bar, and then the staple-former remains stationary while the driver pushes or drives the completed staple into the wood.

It will be understood, of course, that the movable cam j^5 strikes the roll or projection j^6 on the loop-bar before the end of the staple-driver engages the staple, thus automatically retracting or swinging the loop-bar out of the path of the staple-driver, for as soon as the staple is formed and ready to be driven then everything but the completed staple must be removed from the path of the driver in order that such staple may be properly and accurately inserted in the veneering and the cleat which are waiting to receive the staple.

As previously explained, the wire X is fed by the feed-rolls Y and Z, the latter having ratchet-teeth z^2 disposed at one side of its periphery. The pawl z^3, carried by the cross-head M, has its lower end adapted to engage the said ratchet-teeth and rotate the feed-rolls when the cross-head moves upward, thereby giving the wire the desired extent of feed. It will be readily understood that the feeding mechanism can be adjusted in any suitable known or approved manner for the purpose of accurately and properly feeding the wire. As shown in Fig. 17, the staple-former j^4 is provided with a side extension j^{10}, adapted to increase the width of the staple-former. Preferably the said staple-former extension is provided with a bevel j^{11}, corresponding to the bevel j^{12}, but adapted to cut off a longer piece of wire, so as to make a longer staple. When this extension j^{10} is secured to the side of the staple former, it then becomes necessary to retract or withdraw the feed tube j^3, inasmuch as the movable cutting edge is at such time farther away from the loop bar. If a longer staple is desired and if this is accomplished by the means shown in Fig. 17, it is then of course desirable to increase the feed of the wire X—that is, it then becomes desirable to feed a greater length of wire into the space below the staple-former each

time the feed-rolls are operated for such purpose. This may be accomplished in various ways—for example, by providing a relatively larger feed-roll as a substitute for the roll Z, a larger feed-roll of this character being shown in Fig. 7, the diameter of the ratchet-wheel remaining the same as that shown in Fig. 5. The same extent of rotation on the part of the larger feed-roll will of course produce a greater extent of feeding movement on the part of the wire. If desired, a wider staple-former Q, as shown in Fig. 18, may be employed as a substitute for the staple-former *j'*. In other words, the staple-formers Q and *j'* may be employed interchangeably, thereby making it unnecessary to attach and detach the extension *j''*. Of course the staple-former Q is, as shown, of the same width as the staple-former *j'* and its extension *j''*. Any suitable arrangement can be employed for causing the feed-rolls to grip the wire and for permitting the substitution of one feed-roll for another, according to the size of the staples to be driven. Also any suitable arrangement can be employed for permitting the necessary adjustment of the feed-tube *i*. For example, the said tube can be clamped in place by a set-screw R.

As explained, the two chains E and F are adjustable toward and away from each other, so as to accomodate blanks of different widths, and in connection with this adjustability of the work-holder it is of course essential that the stapling mechanisms J, K, and L be mounted for relative adjustment toward and away from each other—as, for example, by mounting the mechanisms J and K for lateral or sidewise adjustment toward and away from the mechanism L. In this way the two outside mechanisms can always be retained in line with the cleats, while the center mechanism can always be retained in a position midway or substantially midway between the cleats.

Any suitable power-transmitting connections, starting and stopping devices, and other like means can be employed for transmitting power to the machine and for controlling the operation thereof.

Thus it will be seen that I provide one or more gibs which are adapted to be applied to the work-holder for the purpose of changing the size of the seats or recesses in which the ends of the cleats are held, it being essential that

the cleats be retained in fixed relation to the work-holder regardless of the size and thickness of the cleats. If a plurality of gibs are provided, they are adapted to be interchangeably applied to the work-holder for the purposes explained. In a similar manner the stapling mechanisms may be equipped with means for varying the length of the staples—as, for example, by providing a plurality of staple-formers, whereby either a wide or a narrow staple-former may be employed in each stapling mechanism, according to the length desired for the staple—that is, according to the thickness of the cleats into which the staples are to be driven for the purpose of securing the veneering and binding-wires thereto.

When completed, the blank consists of a plurality of (preferably four) sections, which are each provided at their opposite ends with a pair of cleats and which are all flexibly [fol. 1683] connected together by the binding-wires, and these binding-wires are adapted to have their opposite ends twisted or otherwise secured together after the completed box is filled and ready for shipment.

It will be readily understood that any suitable means can be employed for feeding the binding-wires onto the upper or outer surface of the blank. For example, these binding-wires U can be fed from the reels V, which latter are supported on brackets *v*, secured to the frame or body of the machine. Each stapling mechanism can be provided with a guide-wheel W, under which the binding-wire can travel. With this arrangement each binding-wire feeds downwardly and underneath its allotted guide-wheel and then below the staple former and driver, to which the said guide-wheel is allotted. In this way the binding-wires are fastened to the blank by the first set of staples and are then pulled or fed forward in unison with the balance of the blank.

It will be seen that the adjustment of the staplers or staple-driving mechanism for the purpose of changing the length of the staples is contingent upon the adjustment of the work-holding means for the purpose of varying the thickness of the materials receiving the staples. In other words, the adjustment of the stapling mechanism to vary the length of the staples is contingent upon the insertion or removal of the gibs. In this way the staples can be

driven into the cleats in such manner as to produce what is commonly known as a "blind clench"—that is to say, a clench within the wood of the cleats, whereby the points of the staples do not pass entirely through the cleats. With the combination of the adjustable staplers and the adjustable cleat holding or carrying means the size or thickness of the cleats can be varied without causing the staple-points to pass entirely through the cleats or without leaving the staples too short, according to the character of the change in the size of the cleats. For this reason the changeable work-holder constitutes an important and distinct feature of my invention, while the combination of the changeable work-holder with the changeable staplers constitutes another important and distinct feature of my invention. So far as I am aware this is the first machine in which these features and combinations have been embodied and employed for the purposes described.

It will be seen that I provide instrumentalities for effecting the insertion of staples of different length—that is to say, whereby staples of one length can be driven for one thickness of cleat and in accordance with one thickness of the bottom walls of the gibs and whereby shorter staples can then be inserted or driven for another thickness of cleat and in accordance with another thickness of the bottom walls of the gibs. It will also be seen that in each case the staple-driver is adapted to drive either a short or a long staple.

What I claim as my invention is

1. A machine for making wire-bound and cleat-reinforced box-blanks, comprising a traveling work holding and guiding device provided with means for holding the cleats in fixed relation thereto, means for guiding the binding-wires onto the outer surface of the blank, and staple forming and driving devices for driving staples to secure the cleats and binding-wires to the body of the blank, together with means for permitting a changing of the size of the cleats, comprising gibs removably applied to the said work-holder for the purpose of adapting the latter to receive and hold cleats of different size, and means for preventing the gibs from being displaced by the drag or back pull of the binding-wires, together with means for spacing the cleats apart endwise in the direction of motion thereof.

2. A machine for making wire-bound and cleat-reinforced box-blanks, comprising an endless traveling work holding and guiding device provided with carriers adapted to engage and hold the cleats in fixed relation thereto, means for guiding the binding-wires onto the upper surface of the blank, and suitable staple forming and driving devices for driving staples to secure the cleats and binding-wires to the body of the blank, together with means for permitting a changing of the size of the cleats, comprising gibs removably applied to the said carriers on the work holder for the purpose of adapting the latter to receive and hold cleats of different width and thickness, and means for preventing the gibs from being displaced by the drag or back pull of the binding-wires, together with means for preventing the said back pull of the binding-wires from causing endwise displacement of the cleats.

3. A machine for making wire-bound and cleat-reinforced box-blanks, comprising a work holding and guiding structure adapted to maintain the cleats in proper relation to each other during longitudinal or endwise movement through the machine, means for guiding the binding-wires onto the upper surface of the blank as the latter travels along, and suitable staple-driving devices for inserting staples to secure the cleats and binding-wires to the body of the blank, together with means for permitting a changing of the size of the cleats, comprising gibs removably applied to the said work holding structure to adapt the latter to receive and hold cleats of different width and thickness, and means for preventing the gibs from being displaced by the drag or back pull of the binding-wires, together with means for securing the cleats endwise in the direction of motion thereof.

4. A machine for making wire-bound and cleat-reinforced box-blanks, comprising a traveling work holding and guiding device provided with means for holding the cleats in fixed relation thereto, suitable provisions whereby the said work holder is adjustable to receive cleats of greater width and thickness, means for feeding the binding-wires onto the upper surface of the blank, suitable staple-forming and driving devices for inserting staples to secure the cleats and binding-wires to the body of the blank, and suitable

provisions for preventing the drag or back pull of the binding-wires from displacing the different parts of the work-holding means and work, together with means for spacing the cleats apart endwise in the direction of motion thereof.

5. A machine for making wire bound and cleat-reinforced box-blanks, comprising means for adjusting the machine for use in connection with cleats of different width or thickness, together with suitable staple forming and driving devices for inserting staples to secure the cleats and binding-wires to the body of the blank, suitable provisions for preventing the drag or back pull of the binding-wires from displacing the different parts of the work-holding means, together with means for preventing the said back-pull of the binding-wires from causing endwise displacement of the cleats.

6. A machine for making wire bound and cleat reinforced box-blanks, comprising a traveling work-holder provided with means for holding the cleats in fixed relation thereto, means for guiding the binding-wires onto the outer surface of the blank, and staple forming and driving devices for securing the cleats and binding-wires to the body of the blank, together with means for permitting a changing of the size of the cleats, comprising gibs removably applied to the said work-holder for the purpose of adapting the latter to receive and hold cleats of different size, the machine also comprising suitable means for giving the blank which is in process of construction a step-by-step feeding motion, whereby the blank is given a step forward each time before the staples are driven, but whereby the blank is always stationary while the staples are being inserted, and suitable means for preventing the gibs from being displaced by the drag or back pull of the binding-wires, together with means for preventing the said back pull of the binding-wires from causing endwise displacement of the cleats.

7. A machine for making wire bound and cleat reinforced box-blanks, comprising a work holding and guiding structure adapted to maintain the cleats in proper relation to each other while moving endwise through the machine, means for guiding the binding-wires onto the upper sur-

face of the blank as the latter travels along, and suitable staple forming and driving devices for inserting staples to secure the cleats and binding wires to the body of the blank, together with means for permitting a changing of the size of the cleats, comprising gibs removably applied to the said work-holding structure to adapt the latter to receive and hold cleats of different width and thickness, the machine also comprising suitable means for giving the blank which is in process of construction a step-by-step feeding motion, whereby the blank is given a step forward each time before the staples are driven, but whereby the blank is always stationary while the staples are being inserted, and suitable means for preventing the gibs from being displaced by the drag or back pull of the binding-wires, together with means for preventing the said back pull of the binding-wires from causing endwise displacement of the cleats.

8. A machine for making wire-bound and cleat-reinforced box-blanks, comprising a traveling work-holding and guiding device provided with means for holding the cleats in fixed relation thereto, suitable provisions whereby the said work-holder can be adjusted to receive cleats of different length, and also to receive cleats of greater width and thickness, means for feeding the binding-wires onto the inner surface of the blank, and suitable staple-forming and driving devices for inserting staples to secure the cleats and binding-wires to the body of the blank, the machine also comprising suitable means for giving the blank which is in process of construction a step-by-step feeding motion, whereby the blank is given a step forward each time before the staples are driven, but whereby the blank is always stationary while the staples are being inserted, and suitable provisions for preventing the different parts of the work-holding means from being displaced by the drag or back pull of the binding-wires, together with means for preventing the said back pull of the binding-wires from causing endwise displacement of the cleats.

9. A machine for making wire-bound and cleat-reinforced box-blanks, comprising means for adjusting the machine for use in connection with cleats of different width and thickness, together with suitable staple-forming and driv-

ing devices for inserting staples to secure the cleats and binding-wires to the body of the blank, the machine also comprising suitable means for giving the blank which is in process of construction a step-by-step feeding motion, whereby the blank is given a step forward each time before the staples are driven, but whereby the blank is always stationary while the staples are being inserted, and suitable [fols. 1685 & 1686] provisions for preventing the different parts of the work-holding means and work from being displaced by the drag or back pull of the binding-wires, together with means for spacing the cleats apart endwise in the direction of motion thereof.

10. In a machine for making cleat-reinforced box-blanks, a traveling work holding and guiding device provided with means for holding the cleats in fixed relation thereto, gibs removably applied to the said work-holder for the purpose of adapting the latter to receive and hold cleats of different size, means for preventing the gibs from being displaced endwise, and means for adjustably spacing the cleats endwise apart in the direction of motion thereof.

11. In a machine for making cleat-reinforced box-blanks, an endless traveling work holding and guilding device provided with carriers adapted to engage and hold the cleats in fixed relation thereto, together with means for permitting a changing of the size of the cleats comprising gibs removably applied to the said carriers on the work holder for the purpose of adapting the latter to receive and hold cleats of different width and thickness, means for preventing the gibs from being displaced endwise, together with means for preventing endwise displacement of the cleats.

12. In a machine of the class specified, adapted for making wire-bound and cleat-reinforced box-blanks, the combination of a traveling work-holder; gibs in the work-holder, each gib having a bottom wall, means for feeding binding-wires; instrumentalities for effecting the insertion of staples of different length; means for preventing endwise displacement of the cleats by the binding-wires, and means for also holding the gibs against displacement, said gibs adapted to be removed to permit the insertion of thicker cleats.

13. In a machine of the class specified, adapted for making wire-bound and cleat-reinforced box-blanks, the combination of a traveling work-holder, gibs in said work-holder, each gib having a side wall, means for feeding binding-wires, means for driving staples, adapted to be moved sidewise, means for preventing endwise displacement of the cleats by the binding-wires, and means for also preventing displacement of the gibs, said gibs adapted to be removed to permit the insertion of wider cleats.

Signed by me at Chicago, Cook county, Illinois, this 31st day of March, 1905.

William P. Healy.

Witnesses: Clarence M. Thorne, Albert Sauser.

(Here follow side folios 1687 & 1688.)

[Fols. 1689 & 1690] United States Patent Office.

Charles O. Wilder, of South Bend, Indiana, Assignor of One Half to Louis Siewert, of Dayton, Ohio.

Shipping-box.

No. 812,564. Specification of Letters Patent. Patented Oct. 2, 1906.

Application filed February 9, 1905. Serial No. 244,852.

To all whom it may concern:

Be it known that I, Charles O. Wilder, a citizen of the United States of America, and a resident of South Bend, in the county of St. Joseph and State of Indiana, have invented certain new and useful Improvements in Shipping-Boxes, of which the following is a specification.

This invention relates to improvements in shipping-boxes, and the object thereof is to provide a box for shipping purposes which will be light of structure and of great strength and in which but little material is used.

No. 832,564 PATENTED OCT. 2, 1906.

C. O. WILDER.

SHIPPING BOX.

APPLICATION FILED FEB. 9, 1906.

Fig. 1.

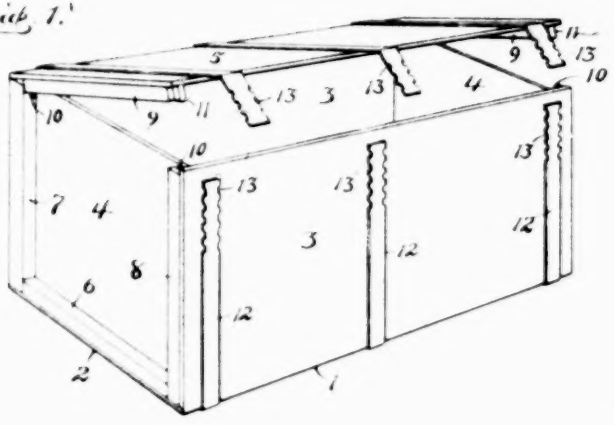


Fig. 2.

WITNESSES

J. M. Dickens

D. J. Campbell

Charles O. Wilder INVENTOR

By W. G. Brown

ATTORNEY

I accomplish my object by the construction illustrated in the accompanying drawings, in which—

Figure 1 is a perspective view of my box with the lid thereof partly open; and Fig. 2 is a detail in perspective, showing the manner of securing the ends of the binding-straps.

Similar numerals of reference indicate corresponding parts throughout both views.

Referring to the drawings, 1 is a box, of which the bottom 2, sides 3, ends 4, and lid 5 are made of thin wood or other suitable material. The ends of the box are reinforced by external strips 6, 7, 8, and 9, the latter being attached to the lid 5 at points thereon so as to come external of the ends 4 when the lid is in place. The tops of the strips 7 and 8 have gains 10 made therein, and tongues 11 extend from the ends of the strips 9 and fit in the corresponding gains 10 when the lid 5 is in proper place.

A series of metallic binding-straps 12 are placed around the box, inclosing the bottom, sides, and lid thereof, and the ends of the straps are of sufficient length as to lap over one another when drawn into place. Each of said ends has a number of notches 13 made in the sides thereof and are uniformly spaced, so that the notches of one end of each strap will register with those of the other. The ends of said straps are secured together by means of plates 14, each having side tongues 15, which are adapted to fit in the registering notches 13 of the corresponding straps and to be clinched over upon the faces of the outer ends of the respective straps, as shown in Fig. 2.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is

In a device of the class described, a box having external reinforcing strips secured at its ends; a removable lid for the box having strips at its ends which correspond respectively with the strips on the ends of the box, the ends of the strips on the lid having tongues, and the corresponding ends of the strips on the box having gains made in their sides respectively next the adjacent ends of the box, the said tongues being adapted to be removably fitted between the ends of the adjacent strips and the corresponding ends of the box respectively when the lid is secured in place; and binding-straps secured around the box and lid.

In testimony whereof I affix my signature in presence of two witnesses.

Charles O. Wilder.

Witnesses: Anna M. Wright, Wm. Westburg.

(Here follow side foliows 1691-1708.)

[fol. 1709] United States Patent Office

Edward Craig, of St. Joseph, Michigan, Assignor to William P. Healy, of Chicago, Illinois

Box-blank machine

No. 864,955. Specification of Letters Patent. Patented Sept. 3, 1907

Application filed August 22, 1906. Serial No. 331,581

To all whom it may concern:

Be it known that I, Edward Craig, a citizen of the United States of America, and a resident of St. Joseph, Michigan, have invented a certain new and useful Improvement in Box-Blank Machines, of which the following is a specification.

My invention relates to machinery for use in making wire-bound and cleat-reinforced box-blanks.

In certain respects, my invention is in the nature of an improvement on the box-blank machine disclosed in Patent No. 815,197 issued March 13, 1906.

Generally stated, the object of my invention is the provision of an improved and highly efficient machine for making wire-bound and cleat-reinforced box-blanks of this particular character.

Special objects of my invention are the provision of improved endless, traveling link-belts for supporting and guiding the cleats of the blanks; the provision of improved means for varying the distance between the two endless,

No. 864,955. 1691-1692

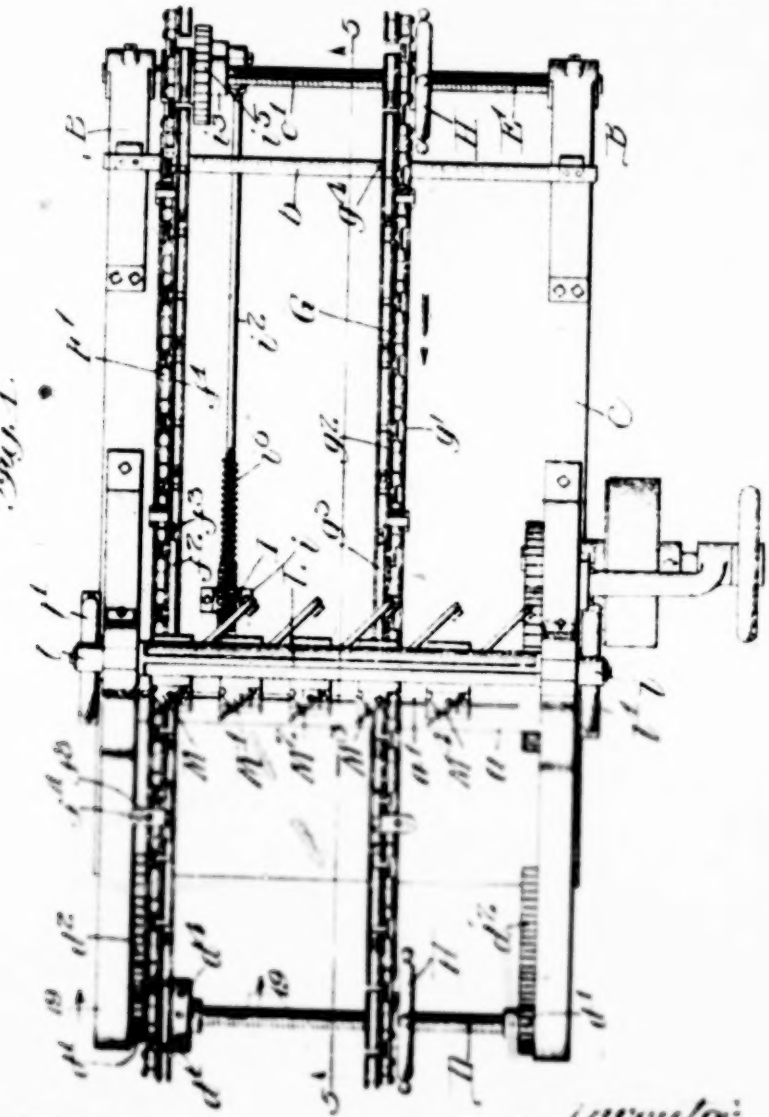
PATENTED SEPT. 3, 1907.

E. CRAIG.

BOX BLANK MACHINE.

APPLICATION FILED AUG. 22, 1906.

9 SHEETS-SHEET 1



Witnesses:
Robert F. Ritter
E. V. Bowman.

Inventor:
Edward Craig
By Bakewell & Burnam
Attys

No. 864,955 PATENTED SEPT. 3, 1907

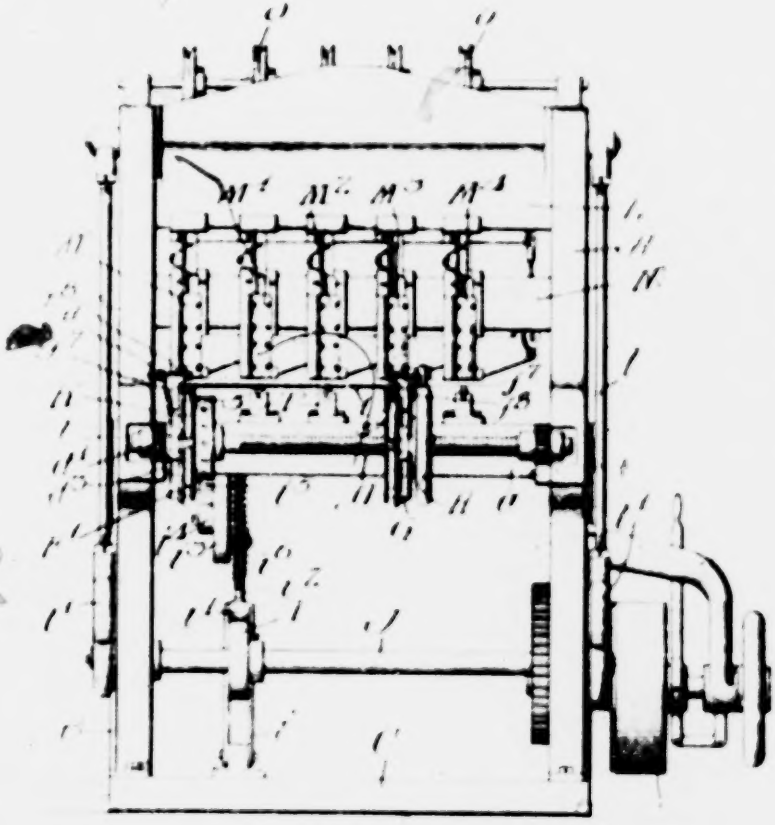
E. CRAIG.

BOX BLANK MACHINE.

APPLICATION FILED AUG 31 1906

2 SHEETS-SHEET 1

Fig. 1.



Witnesses:
Robert Wilkie
E. L. Demarest

Inventor:
Edmund Craig
By Bakewell & Morsell
Attys.

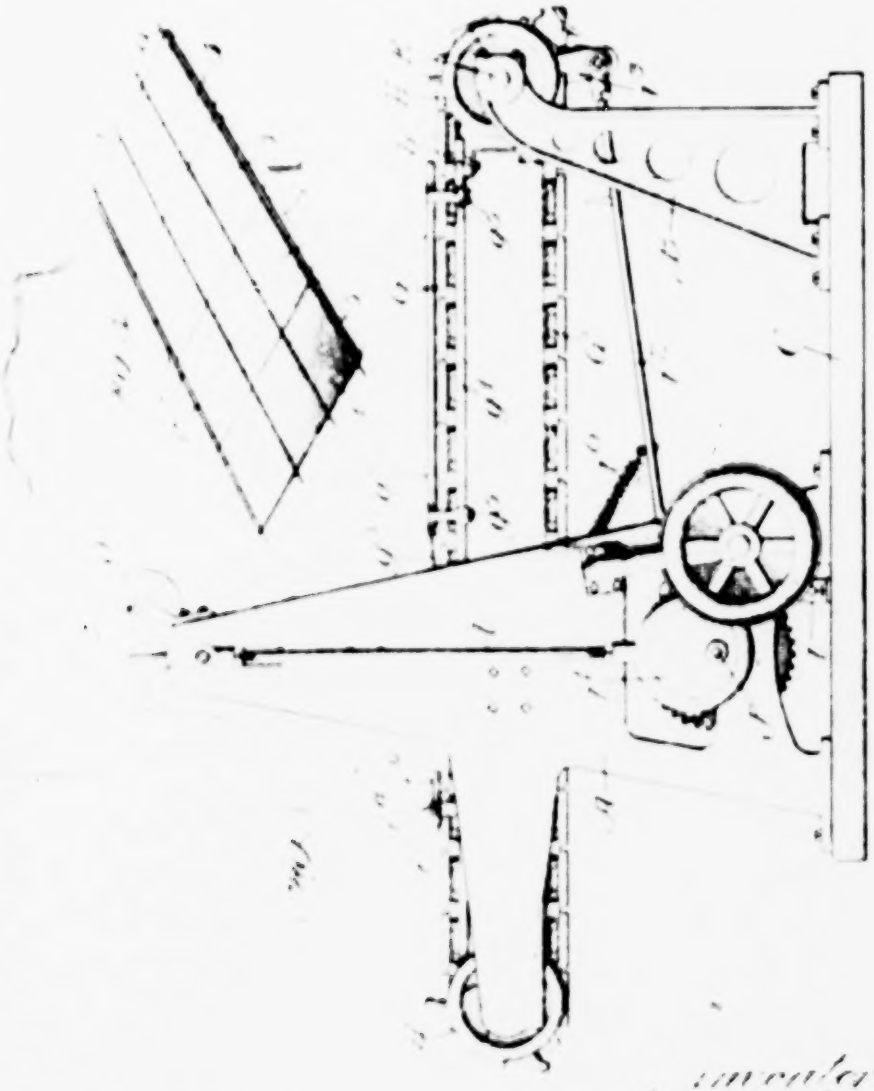
No. 864,955. PATENTED SEPT. 3, 1907

E. CRAIG.

BOX PLANK MACHINE.

APPLICATION FILED AUG. 22, 1906.

4 SHEETS—SHEET 1.



Witnesses:

Gotlieb Kälble

H. C. Sumner

Inventor

Edmund Craig

By Bakewell & Durand

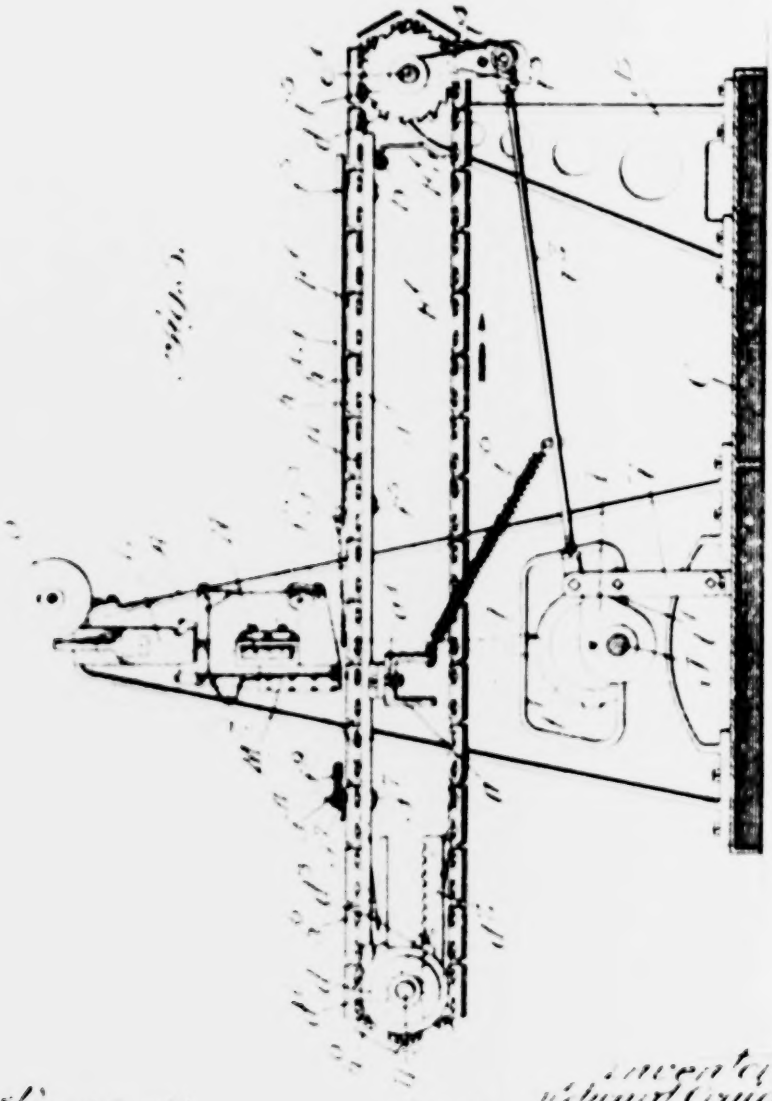
Atty's.

No. 864,905 PATENTED SEPT. 3, 1907

E. CRAIG

BOX BLANK MACHINE

APPLICATION FILED AUG 31 1906 2 SHEETS-SHEET 1



Witnesses:
Robert [illegible]
[illegible]

Inventor:
Edmund Craig
By Bakewell & Byrnes
Attys.

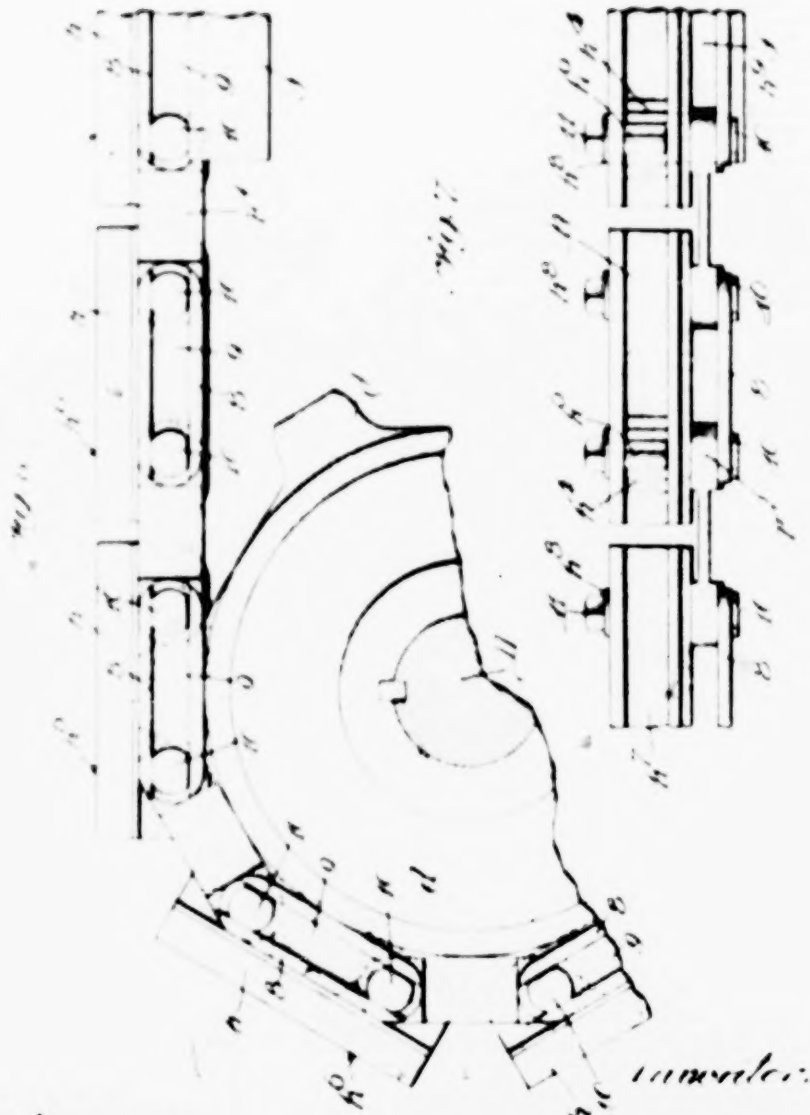
No. 864,955. PATENTED SEPT. 3, 1907.

L. CRAIG.

BOX BLANK MACHINE.

APPLICATION FILED AUG. 29, 1906.

4 SHEETS—SHEET 1.



Witnesses:
Robert Wilkie
H. C. Townsend

Inventor:
Edward Craig
By Bellamy & Durand
Atty's.

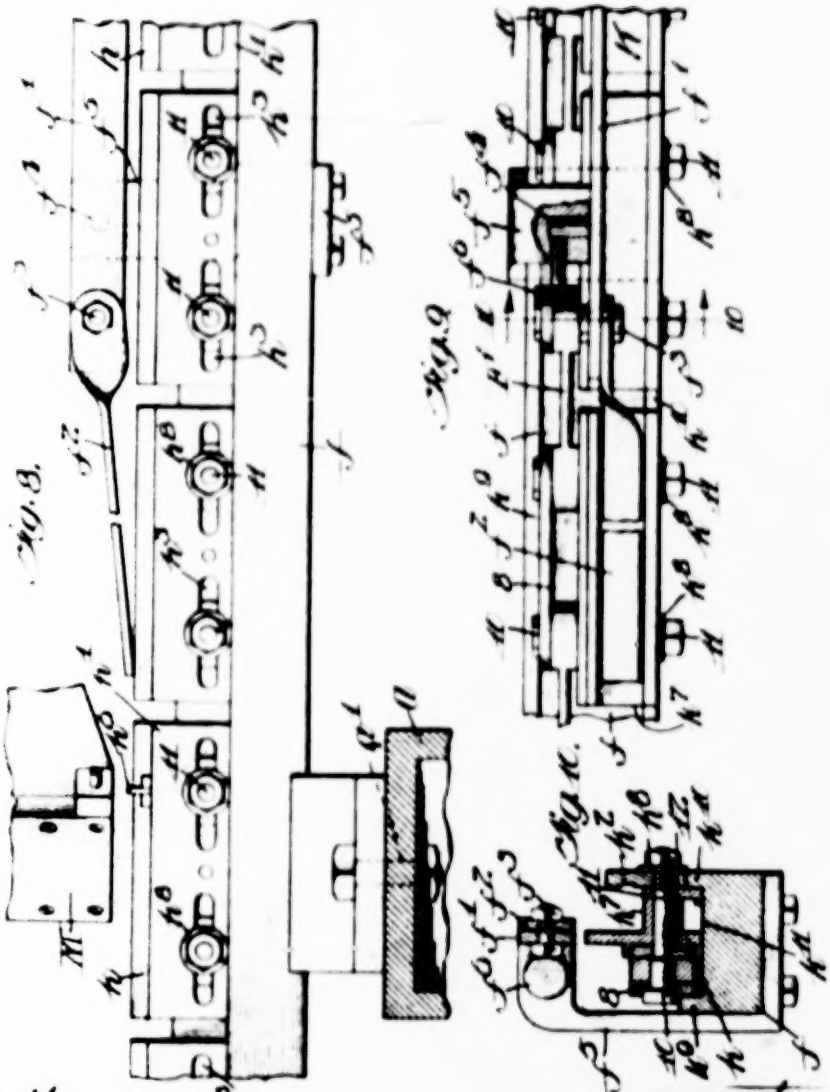
No. 864,955. PATENTED SEPT. 3, 1907.

E. CRAIG.

BOX BLANK MACHINE.

APPLICATION FILED AUG. 22, 1906.

9 SHEETS-SHEET 6



Witnesses:
Robert Walker
L. V. Donnans

Inventor
Edward Craig
By Dodge & Durand
Atty.

No. 864,955. PATENTED SEPT. 3, 1907.

E. CRAIG.

BOX BLANK MACHINE.

APPLICATION FILED AUG. 31, 1906.

3 SHEETS-SHEET 1

Fig. 11.

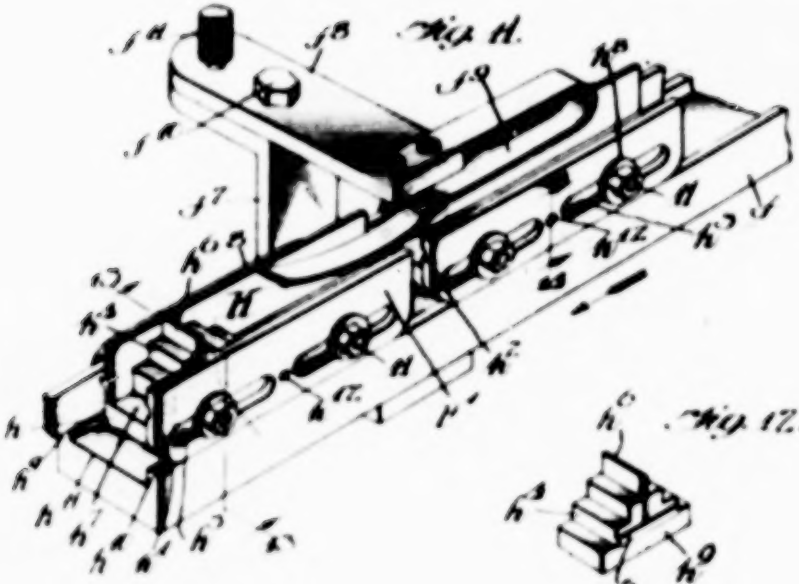


Fig. 17.

Fig. 13.

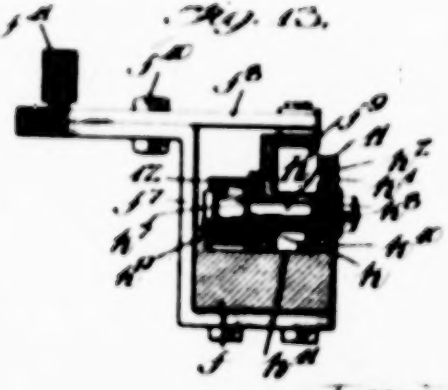
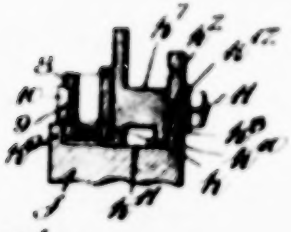


Fig. 12.



Witnesses:
Robert Walker
L. V. Bonnaud

Inventor:
Edward Craig
By Bakewell & Durand
Atty.

No. 864,955. PATENTED SEPT. 3, 1907

E. CRAIG.

BOX BLANK MACHINE.

APPLICATION FILED AUG 28 1906

2 SHEETS-SHEET 2

Fig. 15.

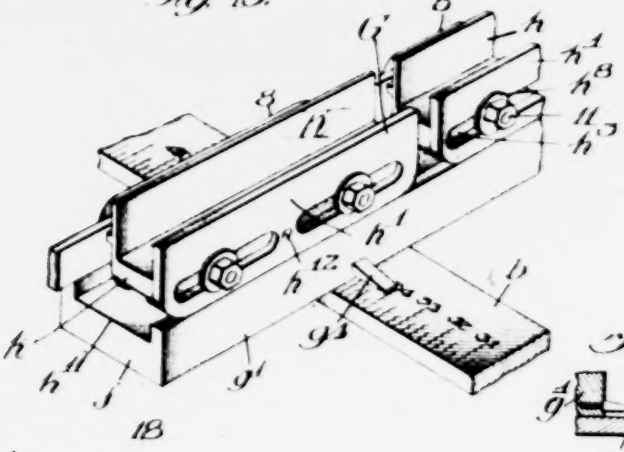


Fig. 16.

Fig. 17.

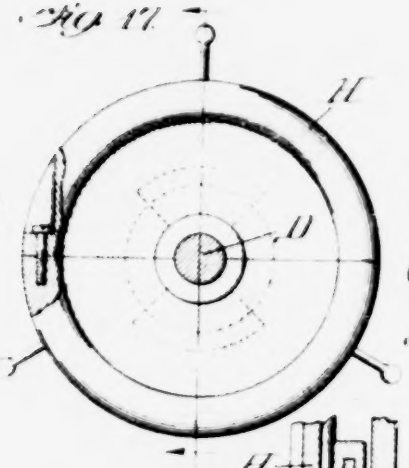


Fig. 18.

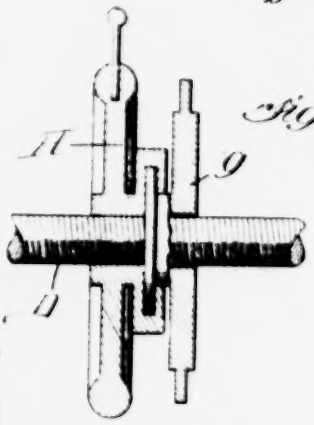
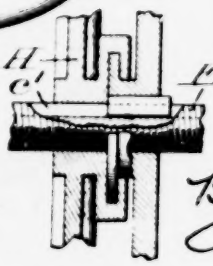


Fig. 22.



Witnesses:
Robert F. Weir
L. V. Donnarus

Inventor:
Edward Craig
By Buckley & Durand
Attys.

No. 864,955. PATENTED SEPT. 3, 1907.

E. CRAIG.

BOX BLANK MACHINE.

APPLICATION FILED AUG 22 1906

9 SHEETS—SHEET 9

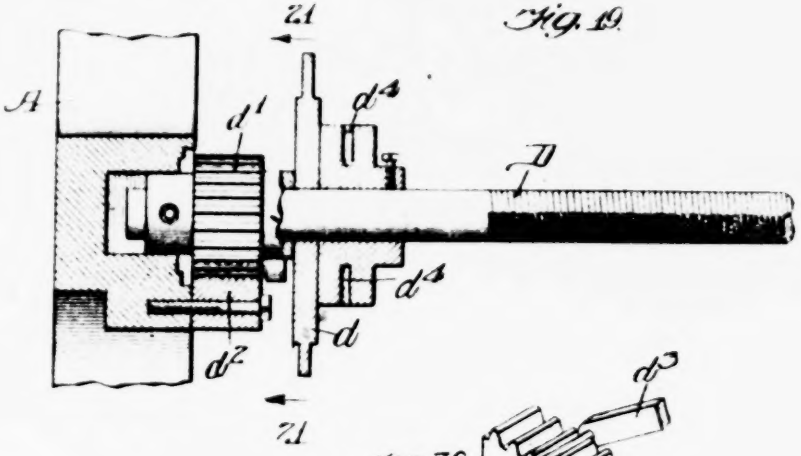


Fig. 19.

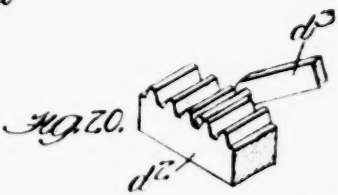


Fig. 20.

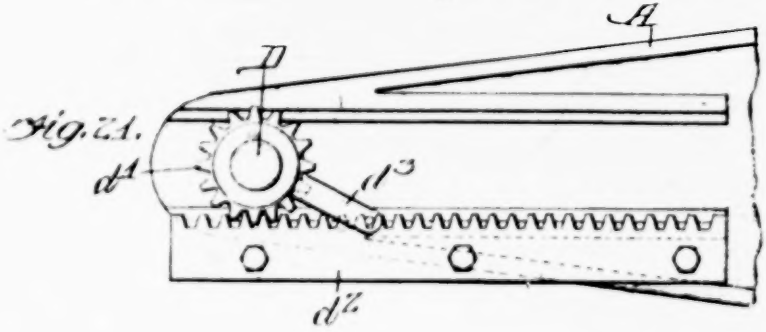


Fig. 21.

Witnesses:
Robert N. Weir
L. V. Demarus

Inventor:
Edward Craig
By Bakewell & Derand
Attys.

traveling link-belts or cleat-carriers, for the purpose of varying the width of the blanks; the provision of a novel and efficient arrangement for readily tightening the endless, traveling link-belts or combined cleat guides and carriers, adapted also to permit lengthening and shortening of the endless traveling link-belts or chains; the provision of improved means for holding the blank materials down upon the travelink link-belts or carriers before the same pass below the staplers which are employed for driving staples to fasten the materials together; the provision of improved means for permitting a variation in the length of the blanks, that is to say, for permitting the use of cleats of different length, and for properly spacing the same apart endwise in the direction of their longitudinal travel through the machine; the provision of improved means for holding the blanks down upon the traveling chains or link-belts after the same have passed out from under the said staplers; the provision of improved means for operating the said traveling link-belts or combined cleat guides and carriers; and the provision of certain details and features of improvement and combinations tending to increase the general efficiency and serviceability of a box-blank machine of this particular character.

To the foregoing and other useful ends, my invention consists in matters hereinafter set forth and claimed.

In the accompanying drawings,—Figure 1 is a plan of a box-blank machine embodying the principles of my invention; Fig. 2 is an end elevation of the said machine; Fig. 3 is a side elevation of the said machine; Fig. 4 is a perspective view of a finished box-blank; Fig. 5 is a longitudinal section on line 5—5 in Fig. 1; Fig. 6 is a detail side elevation of a portion of one of the traveling link-belts or chains, showing also a portion of one of the sprockets; Fig. 7 is a plan of a portion of the chain or link-belt shown in Fig. 6; Fig. 8 is a detail sectional view showing the inner side of a portion of one of the endless chains or link-belts, and showing the device for holding the stock or materials in place before the same pass below the staplers; Fig. 9 is a plan of the devices shown in Fig. 8; Fig. 10 is a cross

section on line 10—10 in Fig. 9; Fig. 11 in a detail perspective view showing a portion of one of the link belts, a portion of the guide in which the link belt travels or slides, and showing also one of the devices for holding the blanks in place after the same pass out from under the staplers; Fig. 12 is a detail perspective view of one of the miter blocks for spacing the cleats apart endwise; Fig. 13 is a detail cross section on line 13—13 in Fig. 11; Fig. 14 is a detail cross section on line 14—14 in Fig. 11; Fig. 15 is a detail perspective view showing a portion of one of the endless link belts or traveling cleat carriers, a portion of the guide in which the same slides, and a portion of the transverse supporting bar for the said guide, said supporting bar being graduated with reference to an indicating pointer on the said guide, whereby accurate variation may be obtained in the width of the blanks; Fig. 16 is a detail sectional view showing the said pointer on the chain guide, and showing a portion of the graduated bar on which the hand wheels for effecting a lateral adjustment of one of the endless traveling link belts or chains; Fig. 18 is a detail sectional view on line 18—18 in Fig. 17; Fig. 19 is a detail longitudinal sectional view of one of the devices for effecting a tightening of the link belts; Fig. 20 is a detail perspective of the locking dog and a portion of the rack of one of said devices; Fig. 21 is a detail vertical sectional view on line 21—21 in Fig. 19; and Fig. 22 is a detail sectional view of the rotary sprocket shaft and hand wheel.

Referring now to Fig. 4, it will be seen that the box blank to be made comprises four sheets of veneer, 1, 2, 3, 4, longitudinally-extending cleats 5 secured to the lower surfaces of said sheets of veneer and extending along the side edges of the blank, together with binding wires 6 secured to the top or upper surface of the blank to flexibly connect together the four sections thereof, it being understood that staples 7 are driven so as to straddle the said wires, and that the staples which secure the outermost wires in place are also employed for securing the cleats to the sheets of veneer.

My improved machine for making a blank of the foregoing general character comprises a main frame or body

A, and an auxiliary or supplemental frame or body B, each of said frames or bodies consisting preferably of a couple of upright members, all rigidly connected together by a base or flooring C. The transverse sprocket-wheel shafts D and E are mounted at opposite ends of the machine and supported for rotation in [fol. 1710] suitable bearings carried by the said upright members of the two frames or bodies. Sprocket wheels, such for example as the sprocket wheel *d*, (shown in Fig. 5) are mounted upon the said shafts, and the two sprockets of one shaft are connected with the two sprockets of the other shaft by means of a couple of parallel and endless link-belts or chains F and G. It will also be seen, at this juncture, that the two upright members of the main frame A are connected by a transverse supporting beam or bar *a*, the same being provided with a longitudinal slot *a'*. The graduated cross bar *b* connects together the two uprights of the auxiliary or supplemental frame B, and has its upper surface graduated in inches and fractions thereof, as shown more clearly in Fig. 15. A stationary, longitudinally-disposed guide-bar or trough *f* is supported upon the cross bars *a* and *b*, and provided on its upper surface with a groove or trough in which the chain or link belt F is supported and travels along during the operation of the machine. The two sprocket wheels provided for the chain or link belt G, as, for example, the sprocket *g* shown in Fig. 18, are each provided with a hand wheel H for effecting lateral adjustment of the chain or link belt G, as will hereinafter more fully appear. This link belt or chain G is supported in a laterally-movable trough or guide bar *g'*, which latter rests upon the transverse supporting bars *a* and *b*, and which is similar to the guide bar *f*. The said guide bars *f* and *g'* are provided with the longitudinally-disposed guards *f'* and *g'*, which extend longitudinally above the two endless traveling link-belts, and which are provided at their forward ends with the pivoted holders f^2 and g^2.

Referring to Figs. 8 and 9, which show the pivoted holder f^2, it will be seen that the same is pivotally mounted at f^3, the pivotal connection being provided by a bolt which

can be tightened or loosened to hold the holder f' in any desired position. The guard f' is provided with pins f^3, which enter the brackets f^2 secured to the guide bar f. Thumb screws f^4 are inserted in said brackets and adapted to bear upon the pins f^3 to removably hold the same in place. With this arrangement, the guards f' and g' can be inserted and removed, it being understood that the two guards are constructed in the same manner.

Referring to Fig. 11, it will also be seen that the guide bar f is provided with a bracket f^5, which supports a pivoted plate f^6, and upon which latter a spring holder f^7 is secured in place to hold the blanks in place after they pass out from under the staplers. The said pivoted plate f^6 is secured in place by a bolt or screw f^{8}, and is held in its adjusted position by a thumb screw f^9. With this arrangement, the thumb screw f^9 can be loosened, and the spring holder f^7 and its supporting plate can then be swung around to a position at one side of the link belt F. It will be seen that the guide bars f and g' are secured by bolts to the cross bars a^2 a^2. Such bolts extend through the slot a', whereby the chain G can be shifted sidewise by a rotation of the hand wheels H. In this connection, it will be seen that the shafts or transverse sprocket supports D and E are screw threaded in order to permit the rotation of the hand wheels H to remove the chain G sidewise for the purpose of varying the distance between the two chains or endless traveling link belts, as will hereinafter more fully appear. Should it be desired to tighten the belt or to change the length of the belt by inserting or removing links, the same can be easily accomplished by partially rotating the shaft D. Upon the ends of this shaft, pinions d' are secured in place, adapted to engage the stationary racks d^2, which latter are parallel and secured to the side portions of the main frame or body A. A locking dog d^3 can be provided for one of said pinions and arranged to lockingly engage the rack upon which said pinion is supported, as shown more clearly in Fig. 21.

It will be seen that the loose sprocket wheel d has an associated collar which is fastened to the shaft, and which is provided with sockets d^4 adapted to receive a tool for

rotating the shaft D. In other words, a suitable tool can be inserted in these sockets, and the shaft D can then be rocked or partially rotated for the purpose of causing the pinions d' to travel along their respective racks, thus varying the distance between the shafts D and E. Thus, with this arrangement, the two parallel link-belts or chains can be easily or readily tightened or loosened, or the length of the same can be readily varied according to the requirements of different kinds of work.

Referring more particularly to Fig. 5, it will be seen that the two endless traveling link-belts are given an intermittent traveling motion by means of an automatic feed arrangement, consisting of a cam I on the main shaft J, a pivoted lever i provided with a roll i' adapted to be engaged by the said cam; a link or rod i^2 connecting the upper end of said lever with a swinging arm i^3, which latter carries a dog i^4 adapted to engage a ratchet wheel i^5. With this arrangement, the rotation of the shaft J causes a reciprocation of the rod i^2, and a consequent intermittent motion of the ratchet device provided by the ratchet wheel i and the dog i^4. This intermittent motion is, of course, communicated to the shaft E, with the result that the two sprocket wheels held thereon are given an intermittent rotation, communicating such motion to the chains or link belts F and G.

It will be understood, of course that the two sprocket wheels which are mounted on the threaded shaft D must be able to turn loosely thereon, inasmuch as this shaft does not rotate during the operation of the machine, but is only rocked or rotated for the purpose of tightening or changing the length of the two traveling link belts. When the two hand wheels H are rotated, an accurate adjustment of the chain G and its supporting guide can be obtained by means of the graduated cross bar b and the pointer g' on the guide g' (see Figs. 15 and 16).

It will be seen that the rod i^2 is actuated in one direction by the spring i^6, which connects the said rod with the cross bar or beam a.

The two traveling link belts or chains are alike, and a description of one will suffice for both. Referring,

therefore, to Figs. 6 and 7, and 11 to 14, inclusive, it will be seen that the chain or link belt F is provided with outer links 8, which have longitudinal grooves 9 adapted to receive the bolt heads 10. These bolt heads are flattened at top and bottom in order to adapt them to fit into said grooves 9, as shown more clearly in Fig. 6. The bolts 11 extend through the links of the chains or link belts, to flexibly connect the same [fol. 1711] together, and also extend through the pockets or cleat carries K. Each cleat carrier preferably comprises an inner member k which is grooved on its side surface to receive an inner link 12 of the chain or belt; an outer member k' which is provided on its inner surface with a longitudinal groove k^2, and which is also provided with longitudinal slots k^3 through which the said bolts extend; and a miter block k^4 provided with a side rib k^5 adapted to engage the groove k^2. The said miter block is clamped between the two members of the pocket or cleat carrier, and is provided at each side with steps adapted to engage the step-mitered ends of the cleats. Each miter block is also provided with a thin top or upper end k^6 adapted to extend between the ends of the two cleats resting thereon. With this arrangement, the said miter block can be adjusted and held at any desired point between the two ends of the pocket or cleat holder K, as shown more clearly in Figs. 7 and 11, the rib k^5 and groove k^2 serving to prevent the said miter block from being raised or displaced from the bottom or floor k^7 of the said cleat holder. The slots k^3 permit endwise adjustment of the cleat holders relatively to each other and relatively to the chains or link belts; it being understood that corresponding slots are also formed in the inner members k of the said cleat holders. Nuts and washers k^8 are applied to the outer ends of the bolts 11, whereby the cleat holders and the miter blocks are all clamped tightly to the inner sides of the two endless traveling link belts. The flattened heads or outer ends of the said bolts, by being adapted to engage the grooves 9 in in the said link belts, prevent said belts from turning. Furthermore, it will be seen that these flattened bolt heads project outwardly to an extent to enable them to rest upon the outer flange k^9

of the trough-like guide-bar f. The lower edges of the outer members k' rest upon the inner flange k^{10} of the said trough-like guide-bar. The said cleat pockets or holders preferably rest firmly upon the bottom or floor k^{11} of the said guide-bar, as shown more clearly in Figs. 13 and 14. At their centers, each outer members k' is provided with an opening adapted to engage a small pin k^{12} inserted in or made integral with the inner member k, whereby the two members of each cleat pocket or holder are always accurately assembled and held together, that is to say, relative displacement between the two members of any cleat pocket is thus prevented. In this way, each traveling link belt or chain is adapted to slide smoothly in its allotted guide-bar, and is also adapted to support the cleats of the blank and carry the same forward for the purpose of advancing the blank material below the staplers; and, in addition, each traveling link belt or chain is provided with improved miter blocks for spacing the cleats apart endwise in the direction of their longitudinal travel. The distance can be varied between the miter blocks, whereby cleats of different length can be inserted in the machine for the purpose of making blanks of various shapes and sizes.

It will be understood, of course, that any suitable arrangement can be employed for driving the staples, by which the binding wires and cleats are secured to the sheets of veneer. For example, the main frame A can be provided with vertical guides for the horizontally-disposed and vertically-sliding cross-head L, which latter is operated by rods l connected with eccentrics l' mounted on the shaft J. As illustrated, the blank is constructed with four parallel binding wires, and for this reason the machine is shown as being provided with four staplers, M, M', M^2 and M^3, together with a fifth or additional stapler M^4, which latter will only be used when the width of the blanks is increased to an extent to make necessary the provision of a fifth binding wire. Anvils or clench blocks are provided for the said staplers, each clench block being mounted upon the cross beam a, and each clench block being held thereon by bolts which extend through the slot a'.

It will be understood that the usual staple drivers and formers are connected with the reciprocating cross head

L, while the wire-feeding devices and anvils or loop bars are carried by the stationary cross head N, which latter is secured to the body frame A. In addition, a corresponding number of wire reels O are provided, adapted to carry the binding wires. These binding wires are led downwardly and guided beneath the staple drivers by any suitable known or approved guiding devices. In this way, the binding wires are stapled onto the blanks, and the intermittent feeding motion of the work-holder, composed of the two traveling link belts, causes the binding wires to be gradually unreeled. When a finished blank arrives at the forward or discharge end of the machine, it can be cut off, or, on the other hand, the flexibly connected blanks can be discharged one after the other, and then separated afterwards. At this juncture, it will be understood that the miter blocks in the chains or link belts are so disposed thereon that a sufficient space is insured between the opposing ends of any two blanks, whereby, when the blanks are finally severed or cut apart, there will then be sufficient length for the ends of the wires to permit twisting of the same together when the blank is finally embodied in a complete box. This spacing apart of the blanks can be accomplished by any suitable adjustment of the miter blocks, as will be readily understood. In order to permit the width of the blanks to be changed, the said staplers are adjustably mounted on the stationary and reciprocating cross heads, thus permitting lateral adjustment of the said staplers. The anvils or clench blocks P are, as previously explained, adjustably mounted on the beam or bar *a*, and are thus adapted to be moved in accordance with any adjustment which may be given their respective staplers. It will be understood, of course, that the said miter blocks prevent endwise displacement of the cleats while the machine is in operation. The drag or back pull of the binding wires is considerable, and in this way the miter blocks have the double function of spacing the cleats apart endwise and preventing the binding wires from causing endwise displacement of the cleats relatively to the chains or traveling link belts.

Each chain or link belt is not only a carrier for the cleats and veneer, but is also a traveling guide for the cleats, inasmuch as each link belt or chain is provided with means

for holding the cleats against lateral displacement therefrom. In other words, the traveling work-holder, composed of the two link belts or chains, is provided with means for holding the cleats in fixed relation thereto,—[fol. 1712] that is, for preventing movement of the cleats in all directions except in an upward direction. Upward displacement of the cleats and veneer is impossible, however, owing to the provision of the aforedescribed guards and holders, which bear upon the sheets of veneer while the materials are passing through the machine.

As a further advantage, it will be seen that the provision of main and supplemental frames or bodies for the machine enables the operator to stand in close to the work-holder, and to thus conveniently load the latter with the required materials as fast as it travels along; or, if desired, the operator can stand at the end of the machine and in a position to conveniently place the cleats in the pockets or holders which are not covered by the guards f' and g^2. The said guards f' and g^2 are not, however, directly over the cavities or pockets of the chains or link belts, but are disposed slightly outside thereof, as shown more clearly in Fig. 10, and thus serve merely to engage the end edges of the sheets of veneer. In this way, the sheets of veneer cannot be displaced transversely or sidewise of the traveling work-holder, but are guided to the point where they are then pressed down by the pivoted holders f^2 and g^3. With this arrangement, the operator can, as previously stated, stand between the main and supplemental frames and load the materials on to the traveling work-holder at a point between the two guards f' and g^2. When the distance between the two chains is varied for the purpose of changing the width of the blanks, the staples and their anvils or clench blocks can then be adjusted so as to bring the two outside staplers directly over the cleats held by the chains or link belts, so as to bring the intermediate staplers into correct position at points between the two chains or link belts. Before turning the hand wheels H, it will be understood, of course, that the bolt which secures the guide bar g' to the beam a must be loosened slightly, thus permitting said bolt to slide in the slot a'. When the proper adjustment has been secured, said bolt can then be tightened, although, in the arrangement shown, lateral displacement of

the guide bars g' is not likely to occur. No clench blocks are, of course, necessary for the staplers which operate directly over the chains or link belts, inasmuch as the staples which are driven at this point are preferably given a blind clench,— that is to say, are not driven entirely through the cleats. Should they be driven through the cleats, they will then be clenched by contact with the bottom walls of the pockets or cleat holders.

It will be seen that the hand wheel H and sprocket g are both loose on the shaft D, the hand wheel gripping the shaft and the sprocket turning in the hand wheel. On the shaft E, however, the sprocket g has a spline which slides in the longitudinal groove e', while the hand wheel H is loose upon the shaft. Both hand wheels are, however, threaded upon their respective shafts.

What I claim as my invention is,—

1. In a machine of the class specified, the combination of a traveling work-holder composed of a pair of endless link belts, means for operating said work-holder, and means including a pair of rack and pinion devices for use in tightening said link belts or permitting a variation in the length thereof by the insertion or removal of links, the pinions movable and the racks stationary.

2. In a machine of the class specified, the combination of a work-holder comprising a pair of endless traveling link belts, means for operating said work-holder, and means including a couple of hand wheels screwed on to a pair of threaded sprocket-wheel shafts for adjusting one link belt toward and away from the other to permit a variation in the width of the work-holder.

3. In a machine of the class specified, the combination of a work-holder composed of two parallel and endless traveling link belts, means for operating said work-holder, means including a pair of rotatable hand wheels for adjusting one link belt toward and away from the other, guides for the upper portions of the link belts and a graduated supporting bar along which the guide of the movable link belt is adjusted to accurately determine the desired distance between the two link belts, each hand wheel rotatable without rotating the other.

4. In a machine of the class specified, the combination of a work-holder comprising a plurality of endless traveling link belts, means including a couple of hand wheels screwed on to a pair of threaded sprocket-wheel shafts for adjusting one link belt toward and away from the other, means for operating said link belts in unison, and a graduated supporting bar extending transversely below said link belts and along which the movable link belt is adjusted to accurately determine any desired width for the workholder.

5. In a machine of the class specified, the combination of an endless traveling work-holder, means for operating said work-holder, and suitable means for operating upon any materials carried by said work-holder, said work-holder comprising a plurality of endless traveling link belts, each link belt provided with longitudinal pockets held end to end, each pocket consisting of inner and outer members providing a trough-like space between them, and a removable miter block in each pocket, said link belts having the links thereof connected by bolts which extend through and clamp in place the two members of each pocket.

6. In a machine of the class specified, the combination of an endless traveling work-holder, means for operating said work-holder, and suitable means for operating upon any materials carried by said work-holder, said work-holder comprising a plurality of endless traveling link-belts, each link belt provided with longitudinal pockets held end to end, each pocket consisting of inner and outer members providing a trough-like space between them, and a removable miter block in each pocket, said link belts having the links thereof connected by bolts which extend through and clamp in place the two members of each pocket, each pocket provided with longitudinal slots through which said bolts extend, whereby said pockets are adjustable longitudinally of the said link belts.

7. In a machine of the class specified, the combination of an endless traveling work-holder, means for operating said work-holder, and suitable means for operating upon any materials carried by said work-holder, said work-holder comprising a plurality of endless traveling link-belts, each link belt provided with longitudinal pockets held

end to end, each pocket consisting of inner and outer members providing a trough-like space between them, and a removable miter block in each pocket, said link belts having the links thereof connected by bolts which extend through and clamp in place the two members of each pocket, each miter block being provided with a rib, and each pocket having its outer member provided with a longitudinal groove adapted to engage said rib, whereby said miter blocks are adjustable longitudinally of their respective pockets without danger of upward displacement therefrom.

8. In a machine of the class specified, the combination of a traveling work-holder, staplers for operating on any materials carried by said work-holder, stationary supports, plates pivoted upon said supports, set screws applied to said pivoted plates to adjustably hold the same in operative position relatively to said supports, and spring holders mounted on said plates and adapted to yieldingly bear upon said materials just after passing from below said staplers.

[Line omitted in copy.]
[fols. 1713 & 1714] of an endless traveling work-holder, sprockets over which said work-holder travels, a shaft for the sprockets at one end of the work-holder, a pair of stationary racks, pinions secured to the ends of said shaft, adapted to engage and travel upon said racks, and means on said shaft for rocking or partially rotating said pinions for the purpose of either tightening or loosening the link belts or permitting a variation in the length thereof by the insertion or removal of links.

10. In a machine for making wire-bound and cleat-reinforced box-blanks, the combination of a traveling work-holder, means for operating said work-holder, and miter blocks on said work-holder adapted to space the cleats apart endwise, each miter block being provided with a longitudinal rib k^3, and said work-holder being provided with longitudinal grooves k^2 adapted to engage said ribs, substantially as set forth.

11. In a machine of the class specified, the combination of a pair of endless traveling link-belts, sprockets for said

link belts, split hand-wheels applied to the sprockets of one of said link belts, and threaded shafts supporting said sprockets.

12. A machine for making wire-bound box-blanks, comprising parallel link belts, pockets in said belts for carrying cleats end to end, adapted to prevent lateral displacement of the cleats, means in said belts for spacing the cleats apart endwise, stationary guides in which said link-belts are supported against lateral displacement, means on said belts for positioning sheet material on said cleats, means for applying binding wires to flexibly connect together the cleat reinforced sections of each blank, and means for suitably moving said belts in said guides.

13. A machine for making wire-bound and cleat-reinforced box-blanks, comprising a plurality of link belts, means on said belts for spacing the cleats apart endwise, means on said belts for preventing lateral displacement of said cleats, spacers on said belts for separating the edges of the sheet material on said cleats, means for suitably operating said belts, and means for applying binding wires to flexibly connect together the spaced or separated sections of each blank.

14. A machine for making wire-bound box-blanks, comprising link-belts, pockets in said belts for holding the cleats end to end, adapted to prevent lateral displacement of said cleats, means for spacing the cleats apart endwise, guides in which said belts are supported, means for operating said belts in said guides, means for applying binding wires to flexibly connect together the sections of each blank, and means for laterally shifting one belt and its guide to change the width of the blanks.

15. A machine for making wire-bound box-blanks, comprising endless link-belts provided with pockets for holding cleats end to end, adapted to space the cleats apart endwise and prevent lateral displacement of the same therefrom, means on said belts for spacing apart the sheet material on said cleats, means for suitably actuating said belts intermittently to successively bring the blanks into position, and means for applying binding wires to flexibly

connect together the slightly separated sections of each blank thus brought into position by said belts.

16. In a machine of the class specified, a plurality of link-belts provided with instrumentalities for holding cleats end to end, adapted to space the cleats apart endwise and prevent lateral displacement of the same, and means on said belts for separating the edges of sheet material on said cleats.

Signed by me at St. Joseph, Berrien county, Mich., this 14th day of August 1906.

Edward Craig.

Witnesses: Chas. W. Stratton, Helen C. Clarke.

(Here follow side folios 1715-1720.)

[fol. 1721] United States Patent Office

William P. Healy, of Chicago, Illinois, Assignor, by Mesne Assignments, to Wirebounds Patents Company, of Kittery, Maine, a Corporation of Maine

Method of Making Wire-bound-box Blanks

1,248,414. Specification of Letters Patent. Patented Nov. 27, 1917

Original application filed May 9, 1910, Serial No. 560,307. Divided and this application filed February 8, 1911. Serial No. 607,448

To all whom it may concern:

Be it known that I, William P. Healy, a citizen of the United States of America, and resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Methods of Making Wire-Bound-Box Blanks, of which the following is a specification.

This is a division of my prior application Serial Number 560,307, filed May 9th, 1910, for improvement in wire bound box blank machines.

DEFENDANT'S EXHIBIT NO. 8.

1716

W. P. HEALY.

METHOD OF MAKING WIRE BOUND BOX BLANKS.

APPLICATION FILED FEB. 8, 1911.

1,248,414.

Patented Nov. 27, 1917.

3 SHEETS—SHEET 1.

Fig. 3.

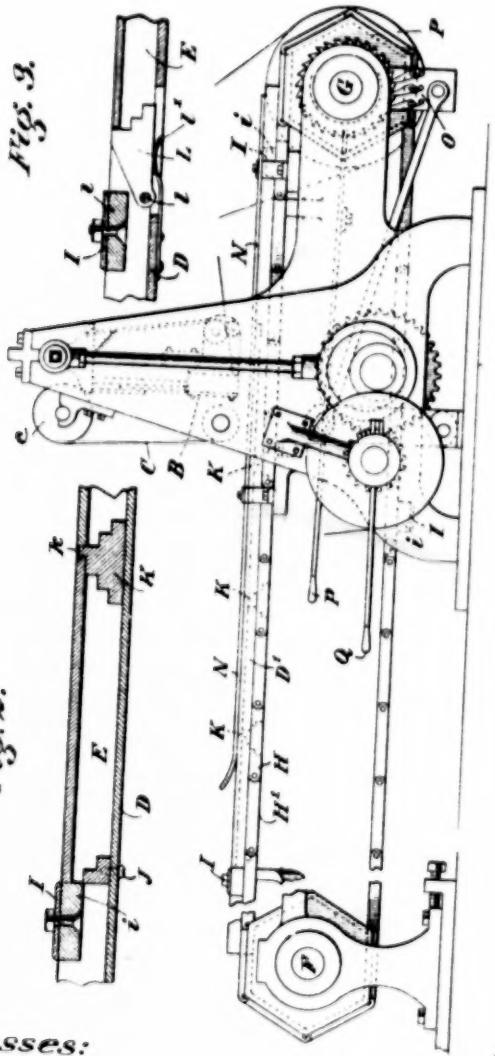


Fig. 2.

Fig. 1.

Witnesses:
E. H. Clegg
A. Lewis

Inventor:
William P. Healy
By Bulkley & Durand
Attorneys

W. P. HEALY.

1717-1718

METHOD OF MAKING WIRE BOUND BOX BLANKS.

APPLICATION FILED FEB. 8, 1911.

1,248,414.

Patented Nov. 27, 1917.

3 SHEETS—SHEET 2.

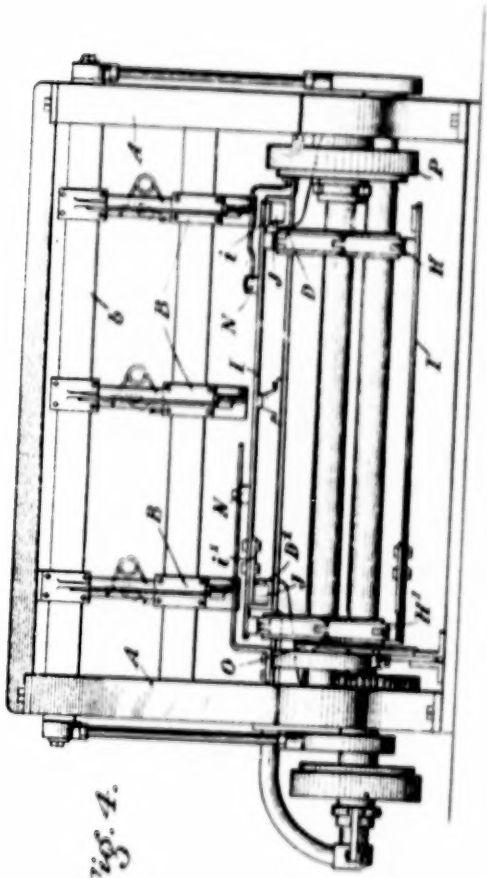


Fig. 4.

Fig. 5.

Witnesses:
E. H. Clegg
S. Senn

Inventor:
William P. Healy
By Bulkley & Durand
Attorneys.

1719-1720

W. P. HEALY.

METHOD OF MAKING WIRE BOUND BOX BLANKS

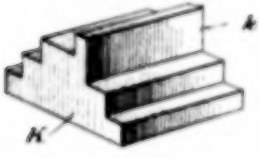
APPLICATION FILED FEB. 6, 1911.

1,248,414.

Patented Nov. 27, 1917.

3 SHEETS—SHEET 3.

Fig. 6



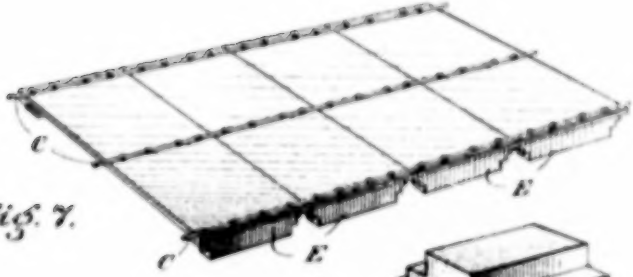


Fig. 7.

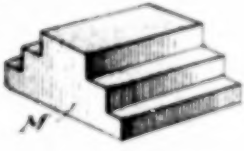


Fig. 9.

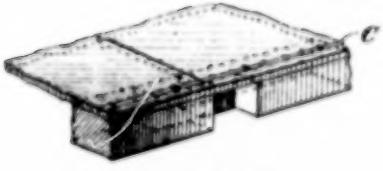


Fig. 8.

Witnesses:
E. H. Clegg
D. Lewis

Inventor:
William P. Healy
By Bulkley & Durand
Attorneys

In the manufacture of wire bound boxes the blanks therefor are made by connecting together sections of veneer, by means of parallel binding wires, and by securing reinforcing cleats to the ends of the sheets, which cleats are arranged end to end in two or more parallel rows. Ordinarily, the said blanks are made by providing blocks for separating the ends of the cleats, so that the materials can be properly positioned while being secured together, and in most cases the blank is moved along by communicating motion thereto through the medium of the spacing blocks, or by communicating uniform motion to the cleats separately, whereby the blank is carried or moved bodily along during the operation of securing the binding wires thereto. With this method, it has been the practice to separate the edges of the veneer, as it has been considered necessary to do this in order that the box when completed may be provided with what are ordinarily known as lapped corners—that is to say, corners that are formed by lapping one sheet of veneer over and upon the edge of the adjacent sheet.

It has been found that the foregoing method is not only unnecessary, but is also very often unsatisfactory, as with such method the corners do not always lap tightly or accurately, as the blank has a tendency to stretch. With my improved method or process, therefore, the edges of the veneer are compressed or squeezed tightly together, and in fact the whole blank is subjected to an endwise compressive force, during the operation of securing the sections of the blank together, whereby the entire length thereof is slightly shortened. By compressing the edges of the veneer together, very tight and satisfactory corners are provided for the box, when the blank is finally folded into shape, and any tendency on the part of the blank to stretch before it is folded, or while being folded, is offset by a slight expansion of the sections of the blank against each other, or toward each other, thus insuring a perfectly tight and satisfactory box after the blank has been folded and secured in place. Also, with my improved process or method, it is not necessary to communicate motion to the cleats separately, as even when the cleats and sections of the blank are separated, as by loose spacing blocks, it still follows that the application of the propelling force only at the rear end of the blank is sufficient to move the same along and keep it in a condition of longitudinal or endwise compression.

My invention contemplates, therefore, the assembling of the different sections of a wire bound blank in place, either with or without spacing blocks between the said sections, the application of a compressive force at one end of the blank, and the resisting or opposing of said force to place the entire blank temporarily under a longitudinal or endwise compression, and the fastening together of the different sections while in this condition. If no spacing blocks are used between the sections of the blank, then the veneer may be fastened to the cleats by tacks or brads, or in any suitable manner, and in this way the edges of the veneer can be compressed or squeezed tightly together, in the manner previously stated, and without the necessity of providing any other means for spacing apart the different sections of the blank. In other words, the overhanging edges of the veneer will constitute the spacing means, being used in this way as a substitute for the ordinary spacing blocks or pins. Thus, and with my improved process, box blanks of this general character can be produced without using spacing devices.

My invention also contemplates, as a direct result of said process, a box blank having the cleats spaced apart by the overhang of the veneer. It further contemplates a box blank having the sections thereof wired together while crowded and held tightly together, whereby the blank is retained under endwise compression, more or less, by the binding wires, and whereby the wire from one section to [fol. 1722] another is under tension, more or less, before the blank is bent around the end wall of the box.

The nature and advantages of my invention will, however, hereinafter more fully appear.

In the accompanying drawings—

Figure 1 is a side elevation of a machine for practising my improved process or method.

Fig. 2 is a detail sectional view of a part of one of the guides for the cleats, and of one of the pushers for moving the materials along, showing the use of loose blocks between the ends of the cleats.

Fig. 3 is a similar view showing a different method of separating the cleats, and a different form of gage for starting the new blank.

Fig. 4 is an end elevation of the machine shown in Fig. 1.

Fig. 5 is a perspective of one of the pushers that are moved by the chains to engage the rear end of each blank to carry the latter under the staplers.

Fig. 6 is a perspective of one of the spacing blocks that may be employed when slight space is desired between the edges of the veneer.

Fig. 7 shows a blank with the spaces between the cleats staggered relative to the joints between the edges of the veneer, said joints being formed without any space between said edges.

Fig. 8 is an enlarged perspective of a portion of a different kind of blank, the ends of the cleats being rabbeted instead of step-mitered, this being a well known form of blank and one which can be made on my improved machine by using a different and well known form of spacing block, or by omitting the said blocks altogether, as will be explained.

Fig. 9 shows a spacing block of the kind suitable for use in making the blank shown in Fig. 7.

As thus illustrated, the said machine comprises a frame or body A upon which the various operative parts are supported in suitably elevated positions. The staplers B are disposed in a row across the machine, and are operated by a suitably actuated cross head *b*, in the usual and well known manner. The binding wires C are fed below the staplers from spools or reels *c* in a manner which will be readily understood. The guides D and D′ extend longitudinally of the machine, below the two outside staplers, and are adapted to receive the cleats E and hold the latter in two parallel and longitudinally advancing rows. These guides are in the nature of channel irons, and the guide D is laterally adjustable to vary the width of the blanks. The machine is provided at opposite ends with transverse shafts F and G having sprockets for the chains H and H′ which run parallel and longitudinally of the machine. The upper portion of the chain H runs inside of the guide D and the chain H′ outside of the guide D, being in substantially the same horizontal plane as said guides. Said chains are connected by transverse bars I, which are called pushers, and which are provided with blocks *i* and *i′* that travel in the guides D and D′ to push the cleats and veneer along. The

block *i'* is adjustable on the bottom or inner side of the pusher in each case, so that it can be adjusted with the guide D for different widths of blank. The machine is long enough to accommodate a blank which is just starting under the staplers, and another which is fully laid and waiting for the next pusher. Out at the end of the machine where the cleats and veneer are laid in place, the guides D and D' are provided with fixed stops or gage pieces J, as shown in Fig. 2, which are of a height to let the pusher blocks *i* and *i'* pass when the latter engage the rear end of the blank. The spacing blocks K are shown with this arrangement, which blocks are loose and slide along the guides with the cleats between the ends of which they are interposed. These blocks are step-mitered where they engage the cleats and are each provided with an upper projection *k* that serves to separate the edges of the veneer in such manner that the end of one cleat is a distance back from the edge of the veneer, while the other cleat extends to the edge of the veneer (see Figs. 2 and 7). In Fig. 3 the stops or gage pieces L for the guides are pivoted at *l* and made high enough to engage the edge of the veneer, so that all four sheets of veneer can be laid and crowded up close together without space between. In such case the blocks M are used between the cleats, and the gage L in each guide is depressed by the pushers to enable the latter to pass and engage the rear end of the newly laid blank. The gage L is then raised to normal position by the spring *l'*, or by any suitable means. Suitable clamps or guides N are provided and arranged to bear upon the blanks while they are traveling under the staplers. These clamps which keep the work from becoming displaced can obviously be made yielding to permit the pushers to pass below. Or the pushers can be disposed in the same plane as the veneer, so that their tops are flush with the upper surface of the blanks, in which case the clamps N do not need to yield upward when the pushers pass under. If the guides engage the edges of the veneer, then the pushers move along the guides a little above the blanks; but if not, or if only one guide engages the edges of the veneer, then the pushers, or at least one end thereof, will travel in the same plane as the veneer. The clamps H can, therefore, be disposed to en- [fol. 1723] gage the tops of the blanks at any suitable points.

A ratchet feed mechanism O is provided at one end of

the machine for giving the shaft G, and chains H and H', an intermittent feeding movement to carry the blanks under the staplers. This feed mechanism is operated in any suitable manner. In addition there is a friction clutch P controlled by a lever *p* for accelerating the motion of the chains, causing the latter to move forward with a quick continuous motion when it is necessary to make the new blank move faster to catch up with the blank which has just been stapled.

In operation it will be understood that the laying of the first blank is started by placing a pair of cleats against the gage pieces J or L, as the case may be. As shown in Fig. 2, a block K is then placed against the end of each cleat, with the projection *k* away therefrom. Then a sheet of veneer is laid on said cleats, and another pair of cleats placed against the said blocks, as shown. This operation is repeated until four sections are in place, care being taken to see that the blocks are all positioned alike, so that the formation at each joint will be the same as the others. When the pushers engage the rear end of the blank, the whole moves forward to the staplers. While this blank is being stapled, another is being laid behind it, and by the time the first blank is finished, another pusher I is ready to engage the new blank. It is at this time that the lever *p* can be used to effect a quick movement forward of the new blank, so that too much space or too long an interval will not occur between the blanks. If the guides have gage pieces L, (see Fig. 3), and if the blocks M are used, then the veneer is all crowded up together without space between, and a blank of the kind shown in Fig. 7 is made. The spaces between the ends of the cleats are staggered relatively to the joints between the edges of the veneer, and this formation is uniform. A blank of this kind can only be folded one way, and no mistakes will be made in folding the blanks.

The machine thus constructed can also be used without spacing blocks, by first tacking the veneer to the cleats. This can be done in any suitable manner, and the cleats and veneer thus preliminarily fastened together can then be placed in the machine and secured together by the wires C, to make a blank like that shown in Fig. 7. In such case the edges of the veneer meet and one sheet or section pushes the other. The overhanging edges of the sheets

serve to space the cleats apart endwise. As the tacks or brads are not necessary for the box, but only as a part of the means for carrying out the method which dispenses with the spacing blocks, it follows that the same are, when thus used, as much a part of the machine as the spacing blocks are when used.

If desired, the form of cleats shown in Fig. 8 can be used, and blanks made by any of the methods described above. Thus the machine will, without any changes therein, work with cleats of different lengths, adjustments only being necessary when the width of the blanks is changed. This can be done quickly, and practically no time is lost in changing from one size of blank to another.

It is obvious, of course, that miter blocks of the ordinary character can be used, with the means for spacing the veneer disposed centrally thereof. It will also be understood that the machine is so controlled by the attendant or operator that sufficient space is left between the blanks, as fast as they are made, to provide the wires, after the blanks are cut apart, with end portions which are long enough to be twisted together to close the box. In this connection it will be seen that the staplers are controlled by the usual friction clutch, which latter is in turn controlled by a hand lever Q in the well known manner. Thus the mechanism for moving the blanks along the guides can be controlled at will and the operation of the staplers can also be controlled at will. It will also be understood, of course, that when the veneer is preliminarily tacked to the cleats, by using tacks or brads, the gage pieces J or L are then not necessary. In such case the sheets of veneer with the cleats secured thereto are simply laid in place in the guides, and they are easily assembled together without using the said gage pieces. The latter can, however, be used, if such is desired.

From the foregoing, it will be seen that the result of any of the above described processes or methods of manufacturing the box blanks is to place the entire blank under endwise compression, while it is being fastened together, so that the different sections of the blank are under more or less compression, the compressive force tending to draw the two ends of the blank toward each other, producing a slight shortening thereof, so that the parts of the blank are secured together while they are thus under com-

pression. Then when the blank afterward stretches somewhat, as it is almost certain to do, such stretching will not objectionably increase its length, and will not interfere with the forming of perfectly tight and satisfactory corners for the box. Of course, when the sections are crowded and compressed tightly together, the tension on the wire will be retained when the blank is flat, although this tension may tend to slightly dish the blank or make it curve when [fol. 1724] left free. But this will not interfere with the folding of the blank around the end walls of the box.

What I claim as my invention is:

1. The process of making a wire bound box blank, which consists in assembling the cleats and sheets of veneer together and in place, with the veneer fastened to the cleats to keep the latter spaced apart endwise, when the sections thus formed are placed edge to edge, placing the sections together with the edges of the veneer engaging each other throughout the blank, applying a longitudinal compressive force at one end of the blank, opposing said force to tightly compress the said edges together, the said compression being communicated from one section to another, and then successively fastening the sections of the blank together, while the same are thus maintained under compression endwise of the blank, by progressively applying a flexible binder thereto.

2. The process of making a wire bound box blank, which consists in assembling the cleats and sheets of veneer together and in place, placing the sections together with the edges of the veneer engaging each other throughout the blank, applying a longitudinal compressive force at one end of the blank, opposing said force to tightly compress the said edges together, the said compression being communicated from one section to another, and then successively fastening the sections of the blank together, while the same are thus maintained under compression endwise of the blank, by progressively applying a flexible binder thereto.

3. The process of making a wire bound box blank, which consists in assembling together the cleats and sheets of veneer of a blank, applying a longitudinally compressive force to one end of the blank, the said compression being

communicated from one section to another, opposing said force at the other end of the blank, to place the sections thereof under compression and shorten the blank, and then fastening the sections together while thus maintained under compression endwise of the blank, by applying a flexible binder thereto.

4. The process of making a box blank, which includes the preliminary fastening of the sheets to the cleats to form blank sections with the sheets overhanging the ends of the cleats, placing in juxtaposition the sections thus formed using the overhanging edges of the sheets to space the cleats apart endwise, maintaining the juxtaposed sections under longitudinal compression communicated from one section to another and applying a flexible binder to successively connect the sections of the blank together by a plurality of alternate feeding and fastening operations for each blank, using said binder to keep the blank under the longitudinal compression communicated from one section to the other.

5. The process of making a wire bound box blank, which consists in fastening side material to the cleats, with the side material overhanging the ends of the cleats, arranging the cleats end to end in parallel rows, using said overhanging side material to keep the ends of the cleats separated or spaced apart, maintaining the sections under longitudinal compression communicated from one strip to another, and wiring the cleats together while thus maintained in proper relation, by a plurality of alternate feeding and fastening operations for each blank, using said binder to keep the blank under the longitudinal compression communicated from one section to the other.

6. The process of making wire bound box blanks, which consists in fastening strips to the cleats, with the edges of said strips overhanging the ends of the cleats, arranging the cleats end to end in parallel rows, using the said overhanging edges to keep the ends of the cleats separated or spaced apart, maintaining the strips under longitudinal compression communicated from one strip to another, and successively wiring the cleats together while thus maintained in proper relation, using said binder to keep the blank under the longitudinal compression communicated positively from one section to the other.

7. The process of making a wire bound box blank consisting of four sections, which includes applying a forward pressure to the rear end only of the blank and successively wiring together the four sections of the blank by a plurality of alternate feeding and fastening operations for each blank, each intermediate section being wired while subject to compression by the opposed pressures of the sections in the front and rear thereof resulting from the forward pressure applied to the rear end of the blank.

8. The process of making a wire bound box blank which includes the successive wiring together of the cleats of the blank in parallel rows by a plurality of alternate feeding and fastening operations for each blank in such manner that each cleat of a row except the last is wired while acted upon by a force tending to press it forward toward the cleat in advance thereof, said pressure being due to a forward pressure applied to the rear end only of each blank.

9. The process of making a wire bound box blank consisting of a plurality of sections, which includes subjecting each section except the last to compression through pressure transmitted by the succeeding section by pushing the latter against the former, and successively wiring together the sections of the blank by a plurality of alternate fas- [fol. 1725] tening and feeding operations, each section except the last being wired while subject to such compression.

10. The process of making a wire bound box blank, comprising the successive wiring together by a plurality of alternate feeding and fastening operations for each blank, of the several sections of each blank, and causing each succeeding section to engage and push forward against the previous section, while the same are being wired together.

11. The process of making a wire bound box blank, comprising the successive wiring together by a plurality of alternate feeding and fastening operations for each blank, of the several sections of each blank, and causing each succeeding section to engage and push forward against the previous section, while the same are being wired together, using the edge portions of the sections to prevent the cleats from engaging at their ends.

12. The process of making a wire bound box blank, comprising the successive wiring together by a plurality of alternate feeding and fastening operations for each blank, of the several sections of each blank, and causing each succeeding section to engage and push forward against the previous section, while the same are being wired together, the sheets being caused to overhang at one edge only of each section, to prevent the cleats from engaging at their ends.

13. The process of making a wire bound box blank, comprising the successive wiring together by a plurality of alternate feeding and fastening operations for each blank, of the several sections of each blank, maintaining the ends of the cleats a distance apart, and holding the sections in position during the wiring operation, by pressure at the rear end only of said blank.

14. The process of making a wire bound box blank, comprising the successive wiring together by a plurality of alternate feeding and fastening operations for each blank, of the several sections of each blank, maintaining the ends of the cleats a distance apart by causing the veneer to overhang the ends of the cleats, and holding the sections in position during the wiring operation, by pressure applied at the rear end only of said blank.

15. The process of making a wire bound box blank, comprising the successive wiring together by a plurality of alternate feeding and fastening operations for each blank, of the several sections of each blank, maintaining the ends of the cleats a distance apart, and holding the sections in position during the wiring operation, by pressure applied at the rear end only of said blank, the sheets and cleats being held together against relative displacement.

16. The process of making a wire bound box blank, comprising the successive wiring of the several sections of the blank together, with the veneer overhanging the ends of the cleats at one edge only of each section, but in the same direction throughout the blank, and maintaining space between the ends of the cleats of the adjacent sections by cooperation of the said overhanging edges of the veneer

with the veneer of the adjacent sections during the said wiring operation.

17. The process of making a wire bound box blank, comprising the successive wiring together of previously unconnected sections, by a plurality of alternate feeding and fastening operations for each blank, with separate cleats for each section, using the cleats to support the sheets, and using means integral with each section for insuring the proper end to end relation of the cleats during the wiring operation.

18. The process of making a wire bound box blank, comprising the successive wiring together of previously unconnected sections, by a plurality of alternate feeding and fastening operations for each blank, with separate cleats for each section, using the cleats to support the sheets, and using means integral with each section for insuring the proper end to end relation of the cleats during the wiring operation, the said means including a portion which extends beyond the cleats of one section into direct contact with the next section.

19. The process of making a wire bound box blank, comprising the successive wiring together of previously unconnected sections, by a plurality of alternate feeding and fastening operations for each blank, with separate cleats for each section, using the cleats to support the sheets, and using means integral with each section for insuring the proper end to end relation of the cleats during the wiring operation, the said means being subject to compression by the crowding together of the sections.

20. The process of making a wire bound box blank, by the wiring together of previously unconnected sections, with separate cleats for each section, comprising the step of maintaining the entire blank under longitudinal compression, by pressure transmitted from one section to the other, during the said wiring operation.

21. The process of making a wire bound box blank, by the wiring together of previously unconnected sections, with separate cleats for each section, comprising the step of maintaining the entire blank under longitudinal compres-

sion, by pressure transmitted from one section to the other, during the said wiring operation, and by direct contact between the edges of the sections.

22. The process of making a wire bound box blank, by [fol. 1726] the successive wiring together of previously unconnected sections, with separate cleats for each section, comprising the step of communicating pressure through each succeeding section to the one ahead, during the wiring operation.

23. The process of making a wire bound box blank, by the successive wiring together of previously unconnected sections, with separate cleats for each section, comprising the step of communicating pressure through each succeeding section to the one ahead, during the wiring operation, by direct contact between the edges of the sections.

24. The process of making a wire bound box blank, comprising assembling separate cleats and side material for each section in relatively fixed relation, and successively wiring together the previously unconnected sections by a plurality of alternate feeding and fastening operations on each blank while the said relation thereto of the side material prevents the wiring operation from causing relative endwise displacement of the cleats.

25. The process of making a wire bound box blank, by the wiring together of previously unconnected sections, by a plurality of alternate feeding and fastening operations for each blank, with separate cleats and side material for each section, characterized by using means integral with the section for ultimately insuring the desired overhang of the sheets and spaces between the ends of the cleats when the blank is finished.

26. The process of making a wire bound box blank, by the wiring together of previously unconnected sections, by a plurality of alternate feeding and fastening operations for each blank, with separate cleats side material for each section, characterized by using means integral with the sections for ultimately insuring the desired overhang of the sheets and spaces between the ends of the cleats when the blank is finished, and causing the material of one section to push directly against another section.

N. E. BROWN.

MACHINE FOR USE IN MAKING METAL BOUND PACKAGES.

APPLICATION FILED OCT. 29, 1904. RENEWED DEC. 29, 1916.

1,276,484.

Patented Aug. 20, 1918.

4 SHEETS—SHEET 1.

Fig. 1.

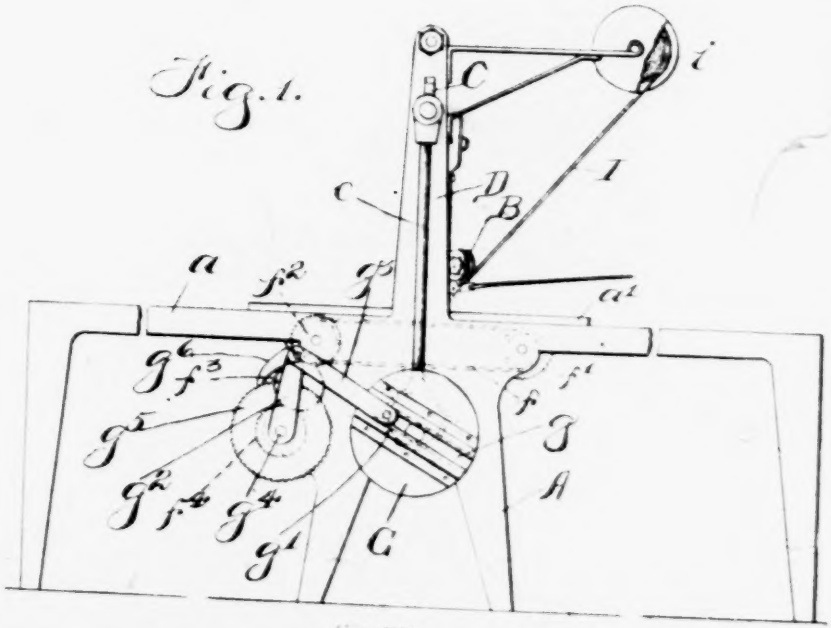
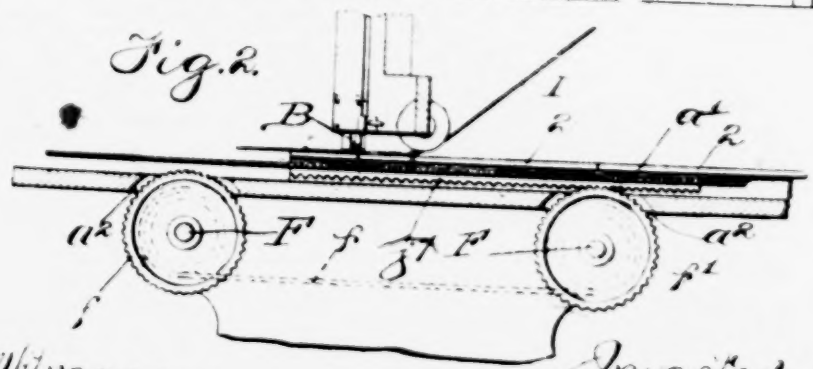


Fig. 2.



Witnesses:
J. B. Weir
Robert Hill

Inventor:
Norman E. Brown
By Bakewell & Worsnop
Attys.

N. E. BROWN.

MACHINE FOR USE IN MAKING METAL BOUND PACKAGES.

APPLICATION FILED OCT. 29, 1904. RENEWED DEC. 29, 1916.

1,276,484.

Patented Aug. 20, 1918

4 SHEETS—SHEET 2.

Fig. 3.

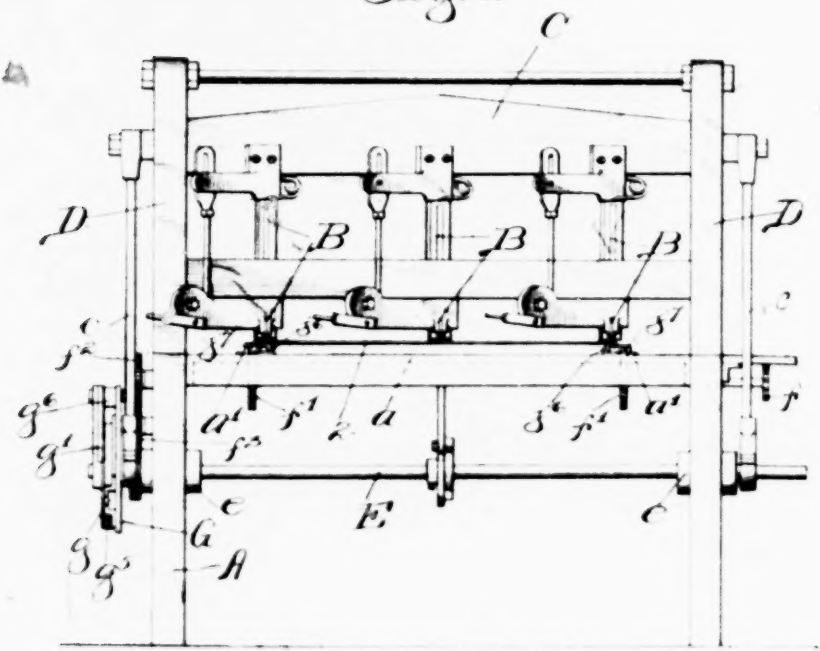


Fig. 4.

Witnesses:

Inventor:
Herman E. Brown
By Bakewell & Church
Attorneys

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4 SHEETS—SHEET 3.

Fig. 5.

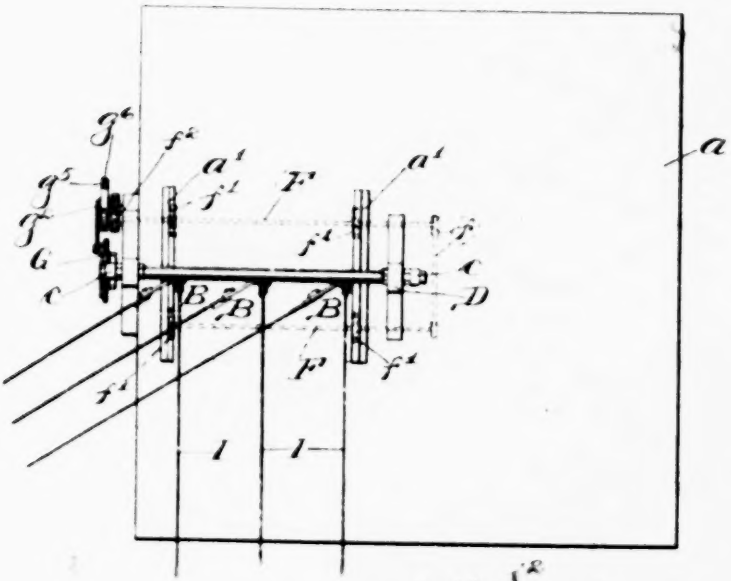

Fig. 6.

Witnesses:
H. W. Clark
Robert F. Allen

Inventor
Norman E. Brown
By Buckley & Durand
Atty.

1733-1734

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4 SHEETS—SHEET 4.

Fig. 7.

Fig. 8.

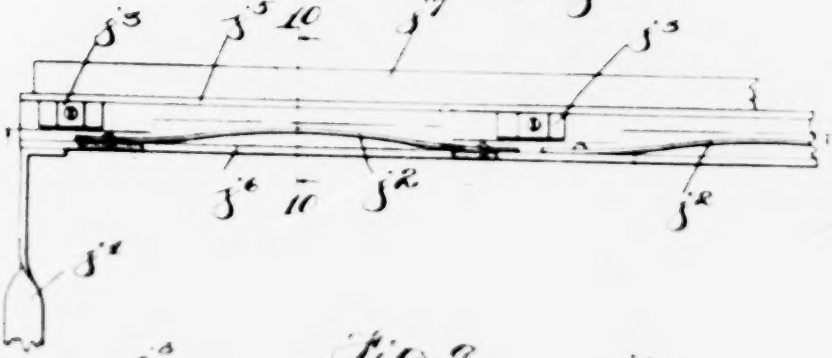



Fig. 9.

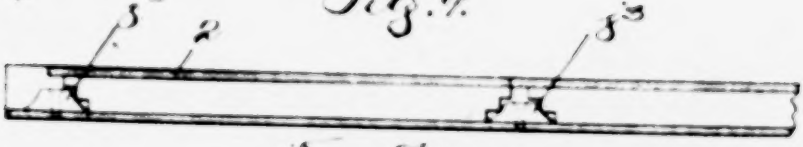


Fig. 10.

Witnesses:
J. B. Wein
Robert Allen

Inventor:
Norman E. Brown
By Bakewell & Durand
Atty.

27. The process of making a wire bound box blank, by the wiring together of previously unconnected sections, by a plurality of alternate feeding and fastening operations for each blank with separate cleats and side material for each section, characterized by using means integral with the sections for ultimately insuring the desired overhang of the sheets and spaces between the ends of the cleats when the blank is finished, and maintaining the binding wires under tension by advancement of the sections.

28. The process of making a wire bound box blank comprising the following steps: securing side material for the respective sides to the respective cleats with the former overhanging the latter thus making side sections, subjecting a series of side sections to compression from the ends of the series to bring the edges of the side material and the ends of the cleats into cooperative foldable relationship, and securing binding wires thereto while they are so held.

Signed by me at Chicago, Illinois, this 22nd day of December 1910.

William P. Healy.

Witnesses: S. Lewis, E. H. Clegg.

(Here follow side folios 1727 1734.)

[fol. 1735] United States Patent Office

Norman E. Brown, of St. Joseph, Michigan, Assignor, by Mesne Assignments, to Wirebounds Patents Company, of Kittery, Maine, a Corporation of Maine.

Machine for Use in Making Metal-bound Packages

1,276,484. Specification of Letters Patent. Patented Aug. 20, 1918

Application filed October 29, 1904, Serial No. 230,478. Renewed December 29, 1916. Serial No. 139,649

To all whom it may concern:

Be it known that I, Norman E. Brown, a citizen of the

rien county, Michigan, have invented a certain new and useful Improvement in Machines for Use in Making Metal Bound Packages, of which the following is a specification.

This invention relates to the manufacture of wire-bound boxes and pertains more particularly to combined fastener-applying and work-controlling mechanisms for use in manufacturing box blanks, or sections of blanks, formed of side sheet material, separate or individual cleats, and reinforcing wires arranged to be secured to the side sheet material and individual cleats.

In a machine embodying this invention the fastener applying mechanism and the work-controlling means cooperate to produce box blanks or blank sections of the character suggested with rapidity and accuracy of relative adjustment of the side sheet material, individual cleats and wires, which is extremely desirable. One of the principal objects of the invention is to provide guiding means for effectually insuring the proper relationship between the box parts and the fastener applying means during the application of fasteners.

The invention is hereinafter described for illustration, as embodied in an organized machine comprising fastener-applying means, work-controlling means arranged to present to said fastener applying means the parts of a blank for a sectional box, and guiding means operatively associated with the work-controlling and fastener-applying mechanisms for insuring that the work shall be presented in desired position relative to the fastener applying means. In the specific illustration machine, the said means cooperate to drive staples, in desired positions, across the binding wires, through side sheet material and into the individual cleats.

In the accompanying drawings,

Figure 1 is a side elevation of a machine embodying the principles of my invention.

Fig. 2 is an enlarged longitudinal section through the central portion of the same.

Fig. 3 is a rear elevation of the machine shown in Fig. 1.

Fig. 4 is an enlarged detail longitudinal section of the central portion of the machine.

Fig. 5 is a plan on a similar scale of the machine shown in Fig. 1.

Fig. 6 is a perspective of the removable or portable work-holder which carries the work through the machine.

Fig. 7 is a perspective of one of the finished box blanks made by a machine constructed in accordance with my invention.

Fig. 8 is an enlarged plan of one side and corner portion of the said work holder.

Fig. 9 is an enlarged longitudinal section through a portion of the box blank resting upon one side of the said work holder.

Fig. 10 is a cross section on line 10—10 in Fig. 8.

As thus illustrated, my improved box blank making machine comprises a suitable frame or body A adapted to support the various operative parts in suitably elevated positions. The said frame or body is preferably provided with a flat top or table *a* whereon the work may be carried across and through the machine. As shown, the said table is provided with parallel guides *a'*. Above the said table, the staplers B are supported and operated by a vertically reciprocating cross bar C, supported in vertically arranged guide ways D. It will be readily seen that the said staplers can be of any suitable, known or approved construction, and can be operated in any suitable or desired manner. Means can be employed for driving fastening devices, such as staples, nails or other devices of any suitable character. With the arrangement shown, a transverse rotary shaft E is mounted in bearings *e* arranged below and each side of said table. This shaft is provided at each end with eccentrics connected by eccentric straps and rods *e'* with the corresponding cross head C. Just below the table, a series of transverse parallel shafts F are provided and connected at their ends through the medium of sprocket wheels and a sprocket chain *f'*. It will be seen that these shafts F are also provided with pinions *f* adapted to project upwardly and slightly above the upper surface of said table. For this purpose, the said table can be provided with series of apertures *a''*, it being preferable that the said pinions project upwardly through the table at points [illegible] just inside of the guides *a'*. It will be seen that the shaft E is also provided with a rotary crank plate G provided with a slot *g*. The crank pin *g'* is adjustable along the length of this slot and is connected with a vibra-

tory arm a by means of links or pitmen a'. This arm a is mounted upon an axis a^2 which is coincident with the axis of the ratchet wheel g. The upper end of said arm is provided with a pawl or dog a^3 adapted to engage the teeth of said ratchet wheel. With this arrangement, the gear wheels f, f', f^2, constitute the medium of power transmitting connections between the said ratchet devices and the pinions f^3. Consequently, when the shaft e is rotated, the staplers are operated, and the pinions f^3 are given an intermittent rotation by the said ratchet devices.

As will hereinafter more fully appear, the wire-supporting device H is located directly below the middle stapler, and is operated by the cam h mounted on the shaft F.

The suitable arrangement and the construction of the wire from which the staples are formed, constitute features of this part of the invention. The wire, or other metal fastening strips, is fed to the staplers from a reel or spool mounted upon a suitable support, and is guided through the machine in a suitable manner. As shown in Fig. 1, the wire w is drawn from the reel w' and passes through the guide w^2 and between the feed rollers w^3 and w^4. The latter rollers are provided with suitable gearing, and are intermittently rotated by the shaft e, so as to feed the wire to the staplers at the proper time. The wire w passes from the rollers w^3 and w^4 through the guide w^5 and thence to the staplers. The guide w^5 is provided with a vertical slot w^6 through which the wire passes, and is mounted upon a suitable support w^7. The wire w is provided with a series of notches w^8 at suitable intervals, which are formed by punching out a portion of the wire, as shown in Fig. 3. The notches w^8 are formed in the wire w at such intervals that when the wire is fed to the staplers the notches will be located at the proper points to receive the staples. The wire w is fed to the staplers by the rollers w^3 and w^4, and is guided to the staplers by the guide w^5, which is provided with a slot w^6 through which the wire passes. The wire w is provided with a series of notches w^8 at suitable intervals, which are formed by punching out a portion of the wire, as shown in Fig. 3. The notches w^8 are formed in the wire w at such intervals that when the wire is fed to the staplers the notches will be located at the proper points to receive the staples. The wire w is fed to the staplers by the rollers w^3 and w^4, and is guided to the staplers by the guide w^5, which is provided with a slot w^6 through which the wire passes.

When introduced into the machine, it will be seen that each work holder lies upon the table and that its racks *j* are engaged by the guides *a*. The attendant pushes the work holder into these guides until the said racks are engaged by the pinions *k* at that side of the machine, and the power is applied. The machine then causes the work holder to move along with an intermittent feeding movement. By this means it guide ways, the side portions of the work holder [illegible] guide blocks. The first staples driven by the [illegible] to fasten the ends of the wires or other metal binding [illegible] to the wood or other material of which the blank is made. After this, the work holder is then actuated so as to feed the work through the machine, and as it [illegible] pass the wires or other metal [illegible] through the [illegible]. It will be understood that each staple when driving straddles the wire or other metal binding [illegible] and extends into the wood or [illegible] of which the blank is composed. For the [illegible] of the side edges of the blank, [illegible] or side portions of the [illegible] that is to say, the [illegible] on the bottoms of [illegible] which are [illegible] the [illegible] each [illegible] the [illegible] and [illegible] the [illegible] and [illegible]

that the wires is directed to and guided through or below the staple-bar, the guides for the chain consisting of the side portions of the work holder, and of the guide-ways in which the guide blocks on the work holder are mounted. The guides for the binding wires may be of any suitable character, but it is obvious that the side portions of the work holder constitute traveling or sliding guides for keeping the motion of the chain direct. Furthermore, the work holder is adapted to receive and retain the back part of the binding wires.

The traveling guides for the chain are provided, it will be seen, with means for preventing the drop or back rod of the binding wires from causing endways displacement of the chain relatively to the said guides. Preferably such means consist of metal blocks fastened to the ends of the chain, and adapted to keep the chain guides separated while the work is advancing through the machine. In this way it will be seen that the side portions of the work holder are provided with means for guiding both lateral and endways movements of the chain, whereby each side portion constitutes both guide for the chain and power transmitting device for the purpose of moving the chain in the direction of the length of the machine.

[illegible]

[illegible]

[illegible]

nism for foldably connecting said sections; means for feeding the work relatively to said mechanism; and means for positively guiding the work in the direction of its feeding movement.

3. A machine for making box blanks comprising, in combination, work-controlling means for positioning a plurality of box sections in cooperative foldable relationship, mechanism for foldably connecting said sections; means for positively feeding the work relatively to said mechanism, and means positively to guide the work during a preliminary feeding movement prior to the commencement of the positive feed.

4. A machine for making box blanks comprising, in combination, work-controlling means for positioning a plurality of box sections in cooperative foldable relationship, mechanism for foldably connecting said sections, means to support the work for a preliminary feeding movement toward said mechanism, means to engage the work and positively feed the same after said preliminary movement, and means positively to guide the work in a path at the time during said preliminary movement.

7. A machine for making box blanks comprising, in combination, cleat-positioning means for a plurality of cleats disposed substantially end to end, constructed and arranged relatively to position adjacent cleat ends in coöperative foldable relationship; preliminary work-supporting means to support the cleats with a frictional engagement permitting a preliminary feeding movement of the cleats; fastener-applying mechanism for foldably connecting the adjacent ends of said cleats; feeding mechanism constructed and arranged positively to engage and feed the cleats, said feeding mechanism being located intermediate said preliminary work supporting means and the fastener applying mechanism; and means to guide the cleats during said preliminary feeding movement.

8. A machine for making box blanks comprising, in combination, cleat positioning apparatus to receive cleats disposed substantially end to end, constructed and arranged relatively to position adjacent cleat ends in coöperative foldable relationship; fastener-applying means foldably to connect the adjacent cleat ends; and feeding mechanism for feeding the cleats relatively to the fastener applying means, comprising an endless chain mounted to move in a path substantially parallel to the direction of feed of the cleats and power-transmitting means operatively connecting the chain and the cleats at different points along the line of feed; and means positively to guide the cleats.

[fol. 1738] 9. A machine for making box blanks comprising, in combination, cleat-positioning apparatus to receive cleats disposed substantially end to end, constructed and arranged relatively to position adjacent cleat ends in coöperative foldable relationship; fastener-applying means foldably to connect adjacent cleat ends; and feeding mechanism for feeding the cleats relatively to the fastener applying means, comprising a pair of shafts disposed transversely of the direction of feed of the cleats, sprocket wheels upon said shafts respectively, a sprocket chain mounted upon said wheels, means for driving the chain, and power-transmitting means operatively connecting the chain and cleats; and means for positively guiding the cleats in the line of feed.

10. A machine for making box blanks comprising, in combination, cleat-positioning apparatus for a plurality

of rows of cleats disposed substantially end to end in each row, constructed and arranged relatively to position adjacent cleat ends in a row, in coöperative foldable relationship; fastener-applying means for foldably connecting the adjacent ends of cleats in the same row; feeding mechanism for feeding the cleats relatively to the fastener-applying means, comprising a pair of rotating wheels for each row of cleats, a shaft for each wheel of one row in common with the corresponding wheel of the other row, a sprocket chain connecting said shafts, and power-transmitting means operatively connecting the cleats with said mechanism; and means for guiding the cleats in the line of feeding movement.

11. A machine for making metal-bound box-blanks, comprising means for guiding the metallic binding onto the blank, suitable means for inserting fastening devices into the blank to secure the metallic binding thereto, and to secure cleats to the inner surface of the blank, a power operated feeding device, and a portable work-holder adapted to carry the blank through the machine, said work-holder being adapted to be connected with said feeding device and, when so connected, constituting a traveling guide for insuring a straight course of travel for the blank, and also constituting a medium through which a proper feeding movement is communicated through the cleats to the said binding, in unison with the motion of the blank, said machine also comprising means for supporting the work-holder in position for movement in a straight line, and the parallel side portions of said work-holder being provided with means for holding the said cleats end to end, in parallel and fixed relation thereto, and for preventing the binding from causing endwise displacement of the cleats thereon, in combination with means for holding said work-holder in operative engagement with said feeding device.

12. A machine for making metal-bound box-blanks, comprising means for guiding or directing the metallic binding onto the blank, means for driving staples into the blank to secure the said binding thereto, and to secure cleats to the inner surface of the blank, a power operated feeding device, and a plurality of interchangeable work-holders adapted to be loaded with the material from which the

blanks are formed and then passed successively through the said machine, each work holder being adapted to be connected with said feeding device and, when so connected, constituting a traveling guide for insuring a straight course of travel for the blank, and also constituting a medium through which the said feeding device communicates motion through the cleats to the said binding, in unison with the motion of the blank, said machine also comprising means for supporting the work holders in position for movement in a straight line, and the side portions of each work holder being provided with means for holding the said cleats end to end, in parallel and fixed relation thereto, and for preventing the binding from causing endwise displacement of the cleats thereon, in combination with means for holding said work holder in operative engagement with said feeding device.

13. A machine for making metal bound box blanks, comprising means for guiding the metal binding to the upper surface of the blank, means for inserting fastening devices for the purpose of securing the parallel binding strips to the blank, and to secure cleats to the inner surface of the blank, a power operated feeding device, and a portable work holder adapted to support the said blank, said work holder being adapted to be connected with said feeding device and, when so connected, constituting a traveling guide for insuring a straight course of travel for the blank, and also constituting a medium through which motion is communicated through the cleats to the said binding strips by the said feeding device, said machine also comprising guideways for supporting and holding the work holder in position for movement in a straight line, and the side portions of said work holder being provided with means for holding the said cleats end to end, in parallel and fixed relation thereto, and for preventing endwise displacement of the cleats thereon.

14. A machine for making metal bound box blanks, comprising means for directing the metal binding to the surface of the blank, means for inserting fastening devices to secure the metallic binding to the blank, and to secure cleats to the inner surface of the blank, and a portable work-holder adapted to carry the blank and serve as a [fol. 1739] traveling guide for insuring a straight course

of travel for the blank, power transmitting connections whereby the work holder serves as the medium through which a feeding movement is communicated through the cleats to said binding, together with stationary guides which engage the said work holder and thereby determine the direction of feed of the said cleats and binding, as well as of the said traveling guide, the side portions of said work holder being provided with means for holding the said cleats in parallel and fixed relation thereto, and for preventing endwise displacement of the cleats thereon.

15. A machine for making metal bound box blanks, comprising means for directing the metal binding to the surface of the blank, means for inserting fastening devices to secure the metallic binding to the blank, and to secure cleats to the inner surface of the blank, a power-operated intermittent feeding device, a portable work holder adapted to be loaded with the material from which the blank is made and then inserted in the machine, said work holder being adapted to be connected with the said feeding device and, when so connected, to serve as a traveling guide for insuring a straight course of travel for the blank, and also as the medium through which an intermittent feeding movement is communicated through the cleats to the said metallic binding, from the said feeding device, together with stationary guides which engage the said work holder and thereby determine the direction of the feeding movement of the said cleats and binding, as well as of the said traveling guide, the side portions of said work holder being provided with means for holding the said cleats in parallel and fixed relation thereto, and for preventing the drag or back pull of the binding from causing endwise displacement of the cleats thereon.

16. A machine for making metal bound box blanks, comprising means for directing the metal binding to the surface of the blank, means for inserting fastening devices to secure the metallic binding to the outer surface of the blank, and to secure cleats to the inner surface of the blank, a traveling work-holder having parallel side portions adapted to hold the cleats end to end, and provided with means for engaging the ends of the cleats, each side portion

having springs for holding the cleats in place, and power transmitting connection for operating said work-holder, the side portions of the work holder constituting sliding guides for keeping the endwise motion of the cleats direct, and also constituting connections by which power or motion is communicated by the machine through the cleats to the said binding, in combination with means for maintaining said work-holder in operative connection in the said feeding device.

17. A machine for making metal-bound box-blanks, comprising means for directing the metal binding to the surface of the blank, means for inserting fastening devices to secure the metallic binding to the outer surface thereof, power-operated means including a traveling work-holder for communicating intermittent motion through the cleats to said binding, said work-holder being provided with side portions adapted to receive and hold the said cleats in fixed relation thereto, and means for holding the said work-holder to a straight line of travel while the cleats are subject to the drag or back pull of the metal binding, and whereby the said side portions of the work-holder slide as guides to keep the endwise motion of the cleats direct.

18. A machine for making metal-bound box-blanks, comprising means for directing the metal binding to the surface of the blank, means for effecting an attachment of the metallic binding to the outer surface of the blank, and of cleats to the inner surface of the blank, together with power-operated means including a plurality of separate longitudinally movable members for communicating motion through the cleats to said binding, said members being adapted to engage and move the cleats endwise, and guide the same, and means for holding said members to straight lines of travel.

19. A machine for making metal-bound box-blanks, comprising means for directing the metal binding to the surface of the blank, means for inserting fastening devices to secure the metallic binding to the outer surface of the blank, and to secure cleats to the inner surface of the blank, a traveling work-holder adapted to engage and move the

cleats endwise, guide the same, and prevent endwise displacement of the cleats thereon, together with means for operating said work holder and thereby communicating motion through the cleats to said binding, and means for holding said work holder to a straight line of travel.

20. A machine for making wire-bound box-blanks, comprising reels on which the binding wires are carried, means for inserting fastening devices to secure the wires to the outer surface of the blank, and to secure cleats to the inner surface thereof, and means including a portable work-holder for pulling the wires off from the reels, and for communicating a step-by-step motion to the said cleats and wires and other portions of the blank, said work-holder being adapted to be loaded with the materials and then inserted in the machine, said machine also comprising means for supporting the work holder in position for movement in a straight line, and the side portions of said work-holder being provided with means for holding the said [fol. 1740] cleats in parallel and fixed relation thereto while subject to the drag or back pull of the binding wires, including devices which hold the work holder against lateral and upward displacement.

21. Means for making box-blanks, including a portable carriage constituting an adjunct applicable to a blank-stitching machine, together with guides for directing binding wires onto the blank, said carriage being provided with parallel cleat-supporting and guiding members for spacing the cleats with relation to each other, and with means for holding the cleats against endwise displacement while subject to the drag or back-pull of the wires, in combination with means for holding said carriage against displacement from its path of travel.

22. Means for making box-blanks, comprising in combination a machine provided with staple drivers, operating means therefor, a frame-like carriage constituting an adjunct applicable to the machine and insertible into and removable therefrom, the carriage constituting means for positioning and holding assembled blank material in proper relation for a box-blank, and for guiding the same, feed

mechanism in the machine for engaging and moving the inverted carriage below the staple drivers, and means for guiding binding wires onto the blank, said carriage being provided with means for holding the cleats against endwise displacement while subject to the drag or back pull of the wires, in combination with means for holding said carriage against displacement from its path of travel.

23. In a machine of the class described, a fastener driving mechanism, a portable work holder having provision for positioning opposed cleats and side material extending between the same, means to positively advance the work holder step by step for presentation of the work to said mechanism, and means positively to guide the work holder in its advance.

24. In a machine of the class described, a gang stapler comprising a plurality of stapling mechanisms spaced in a plane, parallel guides extending transversely across said plane, means to advance assembled cleats and side material intermittently across said plane under control of said guides, said means including a portable work holder having provisions for positioning the cleats and side material, and means to supply binding wire for attachment by said staplers to the side material and cleats.

Signed by me at St. Joseph, Berrien county, Mich., this seventeenth day of October, 1903.

Norman E. Bro[illegible]

Witnesses: John C. St[illegible] Clara E. N. Hatch.

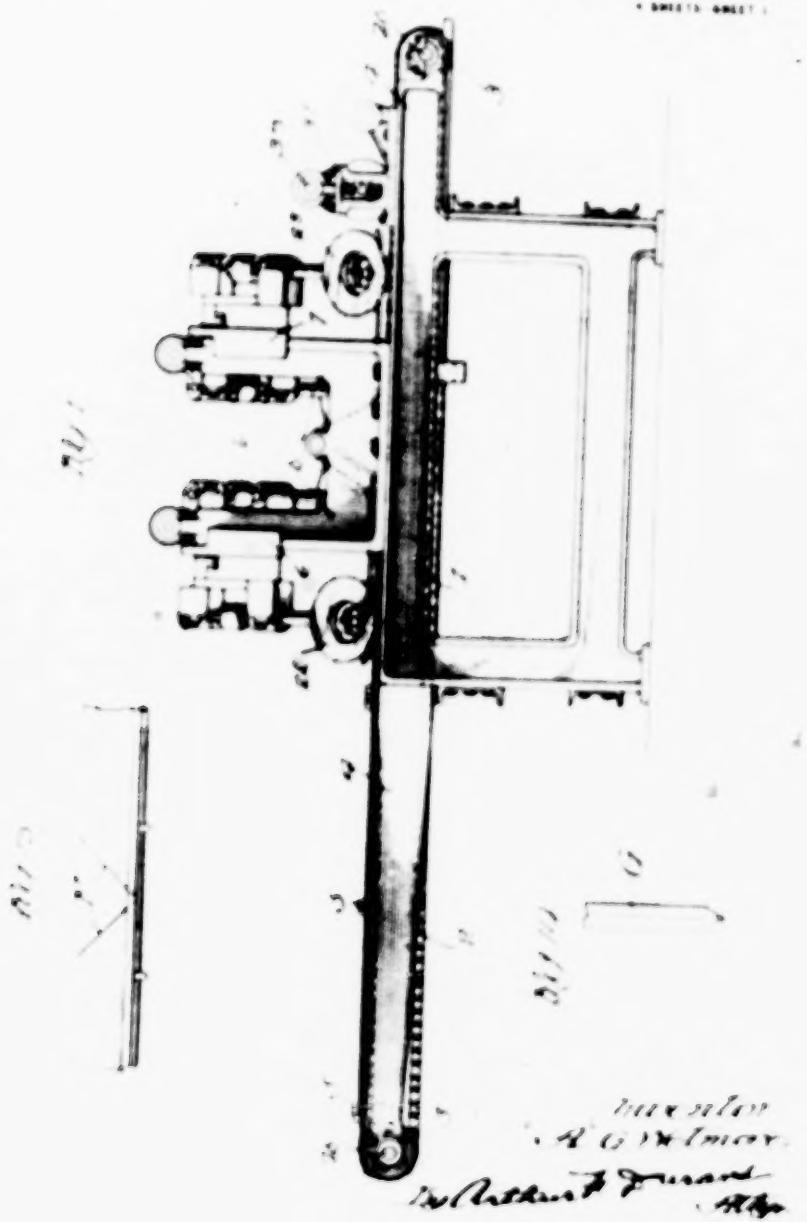
(Here follow side folios 1741 1748.)

1741-1742

A. G. WESTMORE

1,394,593.

Patented Oct. 25, 1921



1,384,893

1 394 893

Another object is to obviate the necessity of using certain methods and features of construction heretofore considered necessary or desirable in the manufacture of wire bound or similar boxes.

It is also an object to provide certain details and features of construction and combinations tending to increase the general efficiency and the desirability of a box of this particular construction, and of a machine of this particular character.

To these and other useful ends the invention consists in matters hereinafter set forth and claimed.

In the accompanying drawings—

Figure 1 is a side elevation of a box blank cutting machine embodying the principles of the invention.

Fig. 2 is an end elevation of said machine.

Fig. 3 is a detail view showing the manner in which the saws cut the V-shaped notches in the cleats of the blank.

Fig. 4 is an enlarged detail sectional view, showing the saws and cutters and work-carrying belt in side elevation, and showing the structure for supporting the saws in vertical section.

Fig. 5 is an enlarged detail view showing the manner in which the two saws coöperate to successively cut first one side and then the other side of a V-shaped notch in the cleat, so that the notch is not complete until after the second saw passes through the cleat, and whereby a groove is cut in the sheet of veneer or other sheet material, in line with the apex of the V-shaped notch, thus forming a line along which the sheet is subsequently severed.

Fig. 6 is a similar view, showing the manner in which the cutter severs the sheet along the bottom of the groove previously formed by the two saws.

Fig. 7 is a perspective of the partially formed or stiff blank, showing the construction and appearance of the same before it is passed through the machine.

Fig. 8 is a similar view showing the construction and appearance of the blank after passing through the machine.

Fig. 9 is a perspective of one end portion of the separate or loose section which, for the particular form of box shown and described, forms the cover or top wall thereof.

Fig. 10 is a perspective of the complete blank flexed into position to receive the heads or end walls of the box.

Fig. 11 is a perspective of one of said heads or end walls, with one edge portion thereof shown broken away for convenience of illustration.

Fig. 12 is an enlarged detail view showing a feature of construction of the box.

Fig. 13 is a detail fragmentary view showing another method of cutting the cleats without grooving the veneer.

Fig. 14 is a detail view showing the form of rotary cutter [fol. 1750] to be used when the veneer is not grooved by the saws and when the rotary cutter is required to perform the entire work of cutting a V-shaped groove in the veneer, with the apex of the groove extending through to the outer surface of the blank.

As thus illustrated, the machine comprises a suitable body frame 1 adapted to support the various operative parts in suitably elevated position. An endless traveling work-holder 2, composed of sprocket chains suitably mounted on sprocket wheels 3 at the opposite ends of the bed or table 4 which forms the top of the body frame, is employed for carrying or propelling the blanks along sidewise, the work-holder being provided with suitable projections or pushers 5 for this purpose, so that the blanks are carried forward in a manner that will be readily understood, the endless sprocket chain work-holder thus formed being supported to slide on the said table, in any suitable or desired manner, so that it will not sag under the weight of the blanks, nor be depressed by the action of the saws and cutters, as will hereinafter more fully appear. Any suitable means can be employed for operating said endless traveling work-holder or carrier, so that the blanks will be propelled or carried forward at the proper speed.

Transversely arranged beams 6 and 7 are disposed a suitable distance above the work-holder, and supported by side frames 8, through the medium of screws 9 which can be adjusted by rotation of the crank shafts 10 which have bevel gears 11 to engage the bevel gears 12 on the upper ends of said screws, said shaft being mounted in bearings 13 on the side frames 8, and having a crank handle 14 for the operation thereof, whereby the beams 6 and 7, which are disposed a suitable distance apart, but preferably in the same horizontal plane, can be raised and lowered to suit the requirements. The beam 6 is formed to provide a

guideway for the sliding supports 15 and 16, at opposite sides thereof, and is formed with a rack 17 at each side thereof to engage the pinions 18 carried by the supports 15 and 16, and by means of handles 19 these pinions are rotated in engagement with the racks to cause the supports 15 and 16 to slide along the beam 6, for a purpose which will hereinafter more fully appear. It will be understood that the rack and pinion arrangement shown in Fig. 2 is duplicated on the other side of the beam 6, and on both sides of the beam 7, whereby there are four racks and four pinions. An inclined shaft 20 is mounted on the support 15, and a similar shaft 21, disposed at the opposite angle, is mounted on the support 16, whereby these two shafts are arranged, one in front and one behind the transverse beam 6, and the lower ends of these shafts are provided with rotary saws 22 and 23 to form the V-shaped notches in the cleats, it being observed that the two saws converge to a longitudinal line disposed immediately over one of the sprocket chains of the traveling work-holder.

It will be seen that the beam 7 is similarly equipped with a pair of saws 24 and 25, which are mounted and operated exactly like those previously described, whereby a V-shaped notch is cut in each cleat directly over another link belt or sprocket chain of the endless traveling work-holder, as shown more clearly in Fig. 2. With this arrangement, the said saws can be adjusted laterally for blanks of different lengths, and the sprocket chains of the work-holder are also adjustable laterally on the shafts 26, in any suitable or well known manner, whereby the entire machine is adjustable for the purpose of making blanks of different lengths. The said saws may, of course, be driven by belts applied to the pulleys 27 on their shafts, or in any other suitable or desired manner. Preferably, the saws are so adjusted or set relatively to each other, that they not only form the V-shaped notches of the cleats, but also cut V-shaped grooves in the sheet of veneer, or other sheet material, to which the long cleats are secured. The arrangement of the saws in pairs in this manner, and with one pair in advance of the other, is of advantage, it will be seen, as in this way the notches in the cleats can be quite close together, if necessary, whereas with the saws all mounted on the same transverse beam, or all in line transversely of the machine,

there would necessarily be a limit to the shortening of the distance between the notches, so that the blanks of less than a certain length could not be made; but, with the construction and arrangement shown and described, blanks of any length, within limits, and with the notches quite close together or farther apart, can be made on one and the same machine.

After the notches are thus formed in the long cleats A of the partially formed or stiff blank, so that V-shaped notches B are formed in the blank, as shown in Figs 7 and 8, and after the grooves C are formed in the sheet of veneer, which grooves preferably extend parallel with the grain of the wood, of course, the partially separated sections of the sheet are then entirely separated from each other by the rotary cutters 28 which are mounted on a shaft 29 behind the saw 25, each cutter consisting of a disk having a sharp edge which will make a thin cut entirely through the sheet without cutting away any of the material thereof, thus leaving the two severed edges of the sheet beveled in [fol. 1751] the manner shown. These rotary cutters are raised and lowered by bevel gear mechanism 30, through the medium of vertically disposed screws 31 that support the boxes or bearings 32 of the shaft 29, so that by rotation of the shaft 33 of said mechanism the cutters can be adjusted up and down in unison, thereby to accurately position their cutting edges in order to cause them to cut through the sheet in the desired manner. It will be seen that these rotary cutters 28 are also directly in line with some of the link belts or sprocket chains of the endless traveling work-holder, so that the veneer or other sheet material is solidly supported below the edges of the rotary knives or cutters thus provided, and whereby a very thin and clean cut will be made through the portion of the sheet remaining after the cutting of the groove therein by the saws. If desired, and with a view to avoiding any injury to the binding wires of the blank, the said wires can be depressed or slightly bent away from the blank, or formed at some stage of the process with kinks at the points where the box side sections meet, as shown at 34 in Fig. 12, and the work-holder may be formed accordingly to receive these bent portions of the binding wires. These kinks 34, of course, tend to draw the sections more tightly together at

the corners of the box, at some stage of the process, as the kinking or looping of the wire in this way tends to shorten the connection between the sections. The cutters 28 have sharp edges, of course, but by this is simply meant that the edges are sharp enough to sever the sheet by the making of a thin and clean cut, without cutting away any of the material of the sheet, so that the two severed edges will not only be beveled, but will also remain in engagement with each other, or very nearly so, thereby to provide a tight joint between the two edges at the corner of a box when the two sections of the sheet are folded relatively to each other in the manner shown. Thus the V-shaped notches and grooves are formed first, and then the rotary cutters 28 roll along in these grooves and complete the operation by totally severing the sheet along tranverse lines, with the result that the partially formed or stiff blank is thereby reduced to a flexible blank which can be folded around the heads or end walls D of the box.

Spring guards 35, of any suitable character, can be employed for holding the blanks down while passing under the saws, and similar or any suitable spring guards 36 can be provided for doing the same thing while the blanks are passing under the rotary cutters 28, thus preventing the blanks from rising and falling while being operated upon by the saws and cutters.

If desired, the end of the shaft 29 can be provided with a belt pulley 37, so that the rotary cutters can be positively driven, thereby to facilitate the cutting action.

As shown in Figs. 7 to 11 inclusive, the construction is of a knock-down character, the cleats being provided with grooves 38 to receive the tongues or ridges 39 formed on the cleats 40 which are secured to the outer sides of the heads or end walls D, in position to thus interlock with the cleats of the blank, thereby holding the heads or end walls in place without the insertion of any fastening devices. It will be understood, however, that ordinary heads or end walls, stapled to the cleats of the blank, in the ordinary or well known manner, can be employed, if such is desired or necessary. Also, as shown, the blank comprises only three sections, which are flexibly connected together by the binding wires 41, in the well known manner, and a separate section E is provided to form the cover or top wall of the box, this

cover having binding wires 42 which have their ends formed with portions 43 to engage the loops 44 on the ends of the wires 41, whereby the cover can be tightly secured in place, the end portions of the wires being twisted or tightened in any suitable or well known manner. It is obvious though, that the invention is not limited to any particular form of box or crate, or to the making of blanks having any particular number of sections. The machine may have as many saws as are necessary to form the desired number of notches in the box blank, depending upon the shape of the box to be made and the number of sections required for the blank, and the rotary knives or cutters which sever the sheet can be arranged accordingly, and can be of any desired number.

By beveling the edges of the sheets, as shown, the two edges themselves are adapted to be brought together, to form a tight joint along the corner of the box when the blank is folded, and the overlapping of one sheet by the other is not necessary, inasmuch as the bevel forms a tight joint between the two adjacent edges themselves, so that a lap joint is not necessary. In this way, therefore, the edge of each sheet is held by the other sheet against displacement inwardly, by pressure on the outside for each sheet opposes the inward flexing of the other. The saws, of course, can be set at any desired angles, so that the two sides of the V-shaped notch will be at right angles to each other, as shown, or at either an acute or an obtuse angle, if such is necessary or desirable, which is one advantage of the V-notch construction shown and described, as distinguished from other formations by which the ends of the cleats have heretofore been brought together.

The cover section E can, of course, be constructed in any suitable or desired manner, by any suitable machinery, so [fol. 1752] that its cleats and edges will properly engage the cleats and edges of the front and back wall sections. It is also obvious that the cleats and wires can be secured to the veneer or other sheet material by staples, in the ordinary manner, and by any suitable machinery, thereby to produce the partially formed or stiff blanks. Thereafter the blanks are passed through the machine shown and described, in the manner explained, thereby to divide the long cleats into as many short cleats as is necessary in order to

produce blanks of the required length, or having the desired number of flexibly connected sections.

The notches E, as previously described, extend, when finished, entirely through the cleats and into the veneer. Obviously, however, notches can be cut which extend entirely through the cleats, without extending into the veneer, if such is necessary or desirable. As shown in Fig. 13, the notch F extends entirely through the long cleat, but not into the veneer. The saws 22, 23, 24, and 25 can be set, of course, by adjusting them in the manner described, so that notches or openings or V-shaped cuts will be made in the cleats, either as shown in Figs. 8 and Fig. 12, or as shown in Fig. 13, depending somewhat upon the character of the veneer or wood or other sheet material employed and the quality and thickness thereof. If the notches or V-shaped cuts are made as shown in Fig. 13, then the V-shaped groove is cut in the veneer by a cutter G, as shown in Fig. 14, and its edge is provided with a double bevel exactly in alinement with the two sides of the notch F, so that the V-shaped groove thus cut in the veneer will extend through to the outer surface of the blank, along a sharp line that will show on the under side of the veneer, which is the outer side when the blank is folded. In such case, these cutters G, which are the same as the cutters 28, but perhaps a little thicker, will be rapidly rotated to actually cut away some of the sheet material, thereby to form the V-shaped groove in the veneer. With this adjustment of the machine, the cleats are subdivided by one step, without scoring or cutting the veneer, and the separation of the veneer into sections is then accomplished by another step in the process or method, by the rapidly rotating cutters G, so that the blank becomes flexible, as previously described. When the machine is set or adjusted to operate as shown in Figs. 5, 6 and 12, the saws make a preliminary groove in the veneer, as explained, and the cutters 28 then merely slit the bottom of such groove, and in this case the cutters 28 of hardened tool steel, for example, can be adjusted to roll on the tops of the link belts, the latter having flat surfaces for this purpose, or even being provided with a slight groove for the edge of the cutter 28, so that the latter will just cut through the veneer, thereby to form the thin and clean and straight line of division or separation on the outer side of the blank, and

in such case the cutter 28 will not cut away any of the sheet material, or is not required to do this. In Fig. 13, however, the operation will probably require an actual cutting away of some of the sheet material, depending somewhat upon the thickness and quality of the sheet material. In either case, however, the sheet material is preferably held down perfectly flat by the presser feet 35 and 36 at each side of the saws, and at each side of the rotary cutters, so that if the material is warped or uneven it will not be improperly cut—that is to say, such warping will not interfere with the cutting of a clean and straight groove of uniform depth and width in the veneer, and will not interfere with the cutting or notching of the long cleats to divide the latter into as many sections as there are sections for the blank.

Thus it is obvious that the invention is not limited to a box of any particular size or shape, or to a box having any particular number of sides, nor to the making of blanks having any particular number of sections, as the number of sections will vary according to the shape of the box, the square or rectangular box shown being merely illustrative of one form of the invention. As shown, the box blank has the cleats secured to its inner surface and the binding wires to the outer surface thereof. Also it will be seen that the invention is not limited to any particular adjustment of the saws, inasmuch as they can be adjusted to merely cut through the cleats, without cutting into the veneer, or may be adjusted to cut through the cleats and into the veneer, thus forming a preliminary groove to receive the rotary cutter; and, while the saws are shown in staggered relation to each other, so that one side of the V-shaped cut is made first, and the other side afterward, it is obvious that both sides of the cut can be made simultaneously by suitable arrangement of the saws, should this method be preferred to the other method or process which involves the formation of one side of the cut first and the other side afterward. By V-shaped notches, it will be understood is meant a cut which extends either entirely through the blank, or a cut which extends only partially through the blank, or through the cleats, for the notching of the inner side of the blank to make it foldable may be done in various ways, and the ultimate severing of the sheet material to form sections which are

6. A structure as specified in claim 1, said instrumentalities being disposed in position to successively cut opposite notches in the cleats nearer one end of the blank, and there-

9. The process of making a box blank, comprising the fastening of cleats and flexible binding members to the sheet material to form a stiff blank having said cleats on the inner surface of the blank and the binding members on the outer surface thereof, cutting notches in the cleats to completely sever and thereby divide each cleat into a plurality of sections, leaving the sections still connected by the sheet material and the flexible members, and completely severing the sheet material transversely in line with said notches, so that the sheet material is entirely divided after the cleats and binding members are secured thereto, finally leaving the sections of the blank connected merely by said flexible members.

10. A process as specified in claim 9, comprising the grooving of the sheet when the notches are cut in the cleats, thereby partially to sever the sheet, and thus forming grooves along which the complete severing is thereafter effected.

17. A structure as specified in claim 1, said instrumentalities being adjustable to cut through the sheet without cutting into the sheet material, if desired, or to cut through the sheets and partially through the sheet material, to form a groove along said line if the latter method is necessary or desirable.

18. The process of making a wire-bound box blank, comprising the fastening of wires to sheet material to form

24. The process specified in claim 23, in which the severing of the sheet material is preceded by the cutting of grooves along the lines predetermined for the severance of said material.

25. The process specified in claim 23, in which the notches are cut successively in each cleat, and the sheet material is

grooved along the lines predetermined for the subsequent complete severing of said material.

26. The process specified in claim 23, in which the cutting of said notches precedes the complete severing of the sheet material.

Albert G. Wetmore.

(Here follow side folios 1755-1772.)

[fol. 1773] United States Patent Office

Edward Craig, of St. Joseph, Michigan, Assignor, by Mesne Assignments, to Saranac Machine Co., of S. Joseph, Michigan, a Corporation of Michigan

Box-blank Machine

1,132,515. Specification of Letters Patent. Patented Mar. 16, 1915

Application filed February 23, 1906, Serial No. 302,631. Renewed December 7, 1914. Serial No. 875,975

To all whom it may concern:

Be it known that I, Edward Craig, a citizen of the United States of America, and resident of St. Joseph, Berrien county, Michigan, have invented a certain new and useful Improvement in Box-Blank Machines, of which the following is a specification.

My invention, as herein described and illustrated relates to machinery for making crate-sides of that particular character in which a plurality of long slats are properly spaced and held together by transverse end and intermediate slats. It will be seen, however, that many of the features and combinations of my invention are applicable to machinery for making various kinds of box and basket blanks, such, for example, as the wire-bound box blanks having end cleats for reinforcing the same, as well as many other blanks or articles of this kind.

DEFENDANT'S EXHIBIT NO. 18.

VOLUME OF PATENTS OWNED BY DEFENDANT.

1757-1758

E. CRAIG.

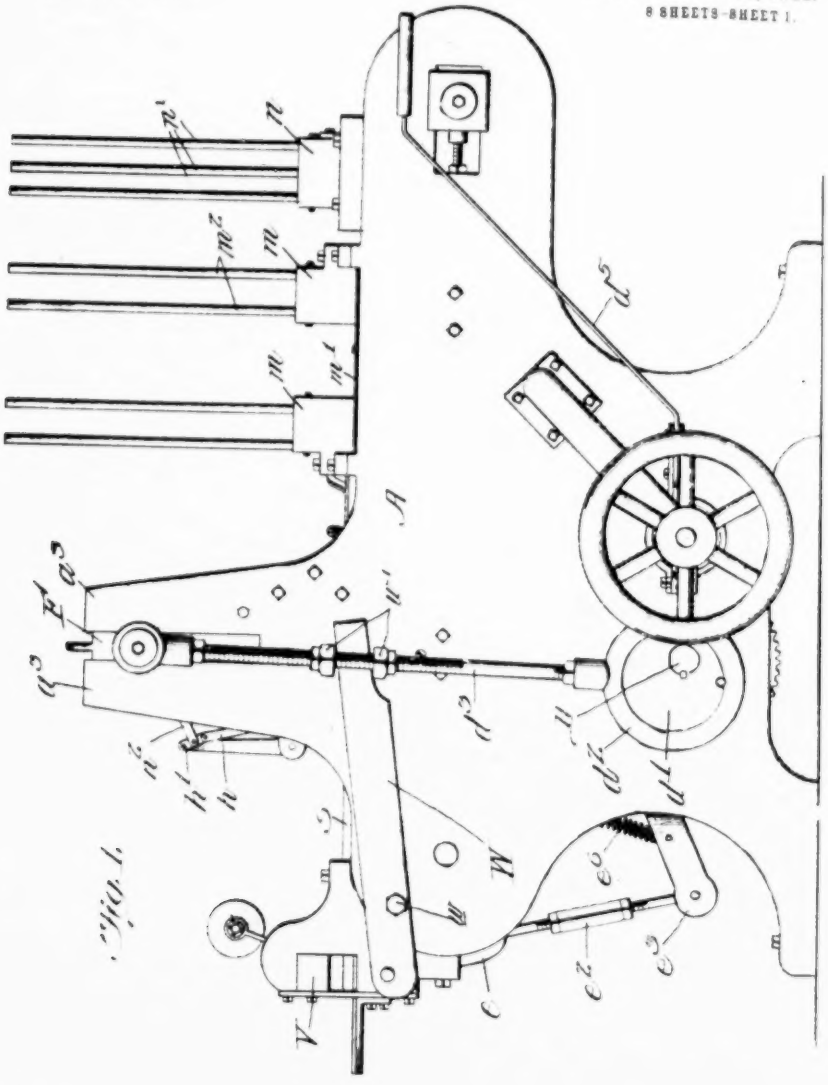
BOX BLANK MACHINE.

APPLICATION FILED FEB. 23, 1906. RENEWED DEC. 7, 1914.

1,132,515.

Patented Mar. 16, 1915.

8 SHEETS—SHEET 1.



Witnesses:
Robert N. Dair
A. L. Bird.

Inventor:
Edward Craig
By Buckley & Durand
Attys.

E. CRAIG.

BOX BLANK MACHINE.

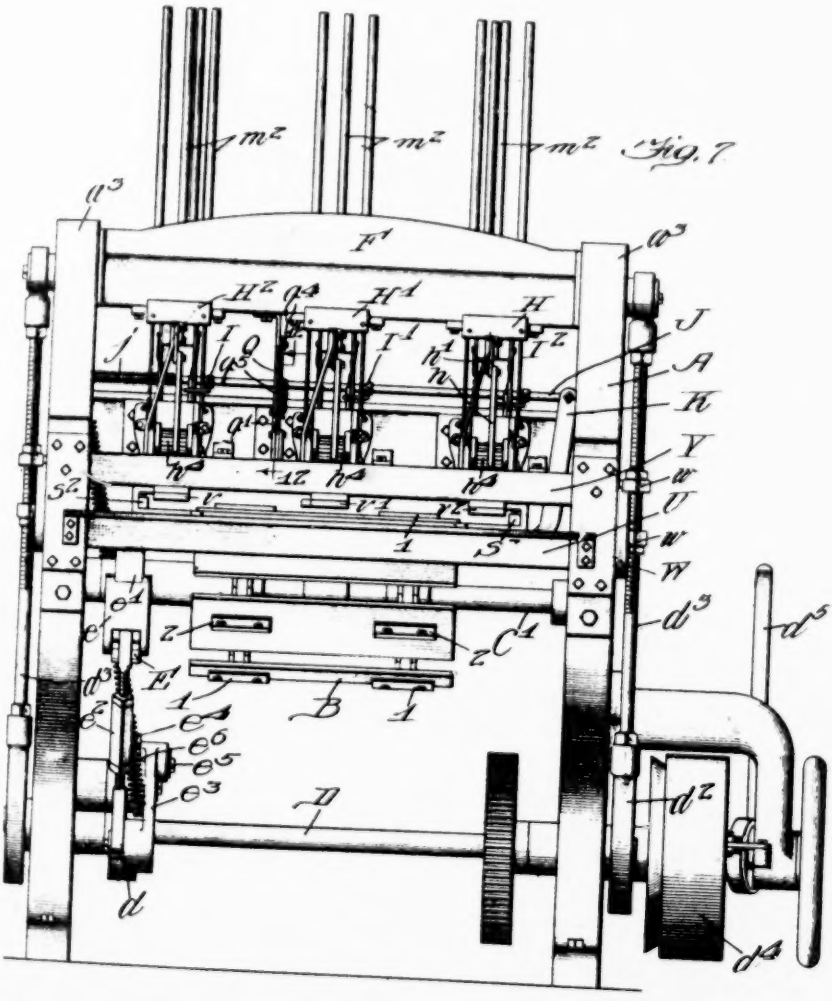
APPLICATION FILED FEB. 23, 1906. RENEWED DEC. 7, 1914.

1,132,515.

Patented Mar. 16, 1915.

8 SHEETS—SHEET 2.

Fig. 7.



Witnesses:

Robert Alber

A. L. Bird.

Inventor,

Edward Craig

By Buckley & Durand

Attys.

1761-1762

E. CRAIG.

BOX BLANK MACHINE.

APPLICATION FILED FEB. 23, 1906. RENEWED DEC. 7, 1914.

1,132,515. Patented Mar. 16, 1915.

8 SHEETS—SHEET 3.

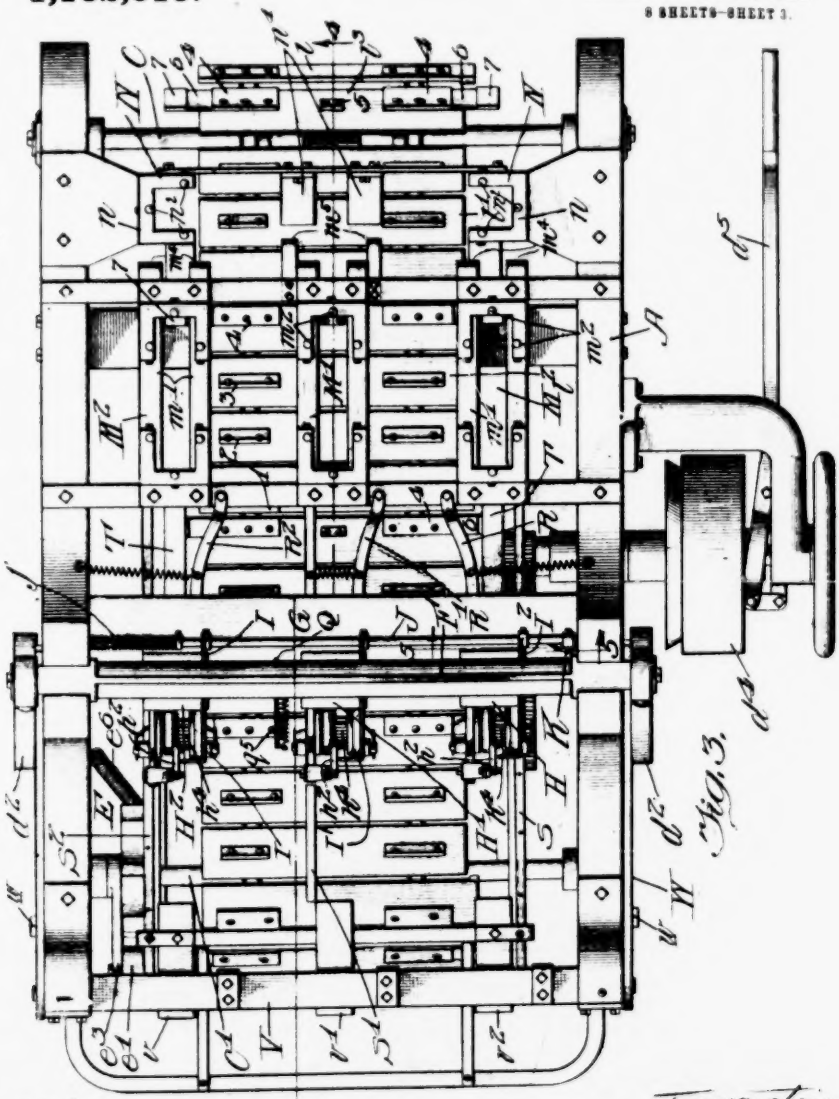


Fig. 3.

Witnesses:
Robert N. Weir
A. L. Bird

Inventor:
Edward Craig
By Buckley & Durand
Atty.

1763-1764

E. CRAIG.

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APPLICATION FILED FEB. 23, 1906. RENEWED DEC. 7, 1914.

1,132,515.

Patented Mar. 16, 1915.

8 SHEETS—SHEET 4.

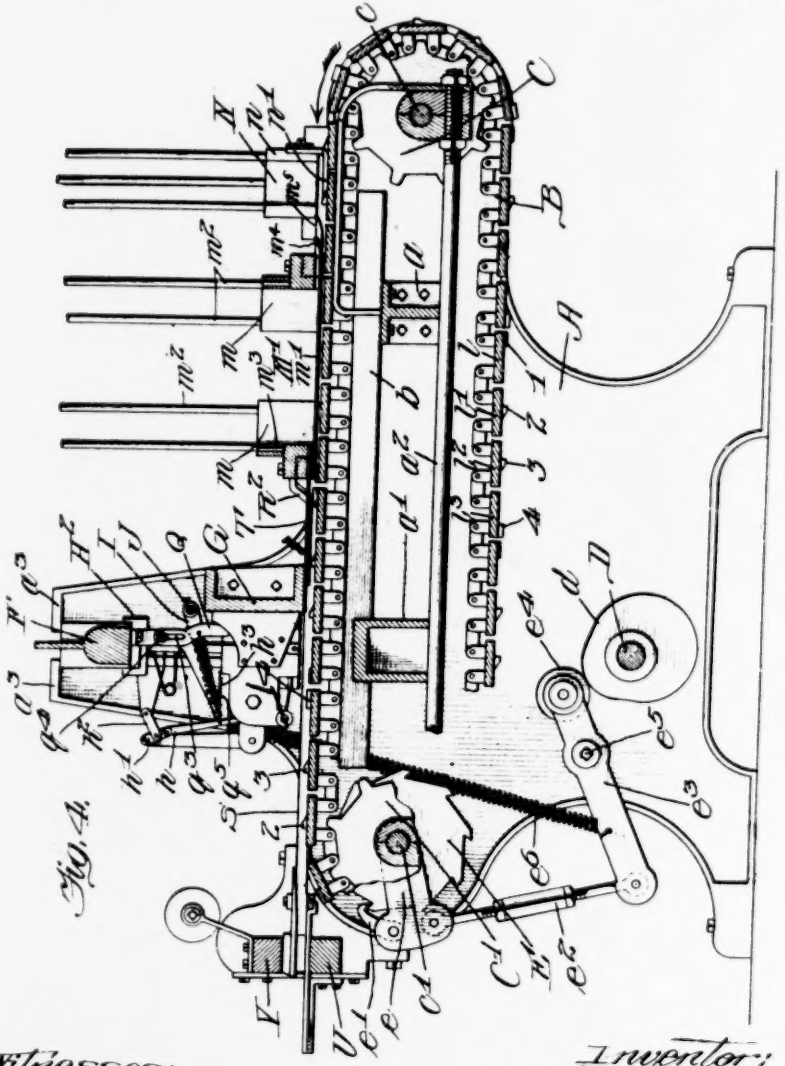


Fig. 4.

Witnesses:
Robert A. Weir
A. L. Bird.

Inventor:
Edward Craig
By Buckley & Durand
Attys.

1765-1766

E. CRAIG.

BOX BLANK MACHINE.

APPLICATION FILED FEB. 23, 1906. RENEWED DEC. 7, 1914.

1,132,515. **Patented Mar. 16, 1915**

6 SHEETS—SHEET 5.

Fig. 5.

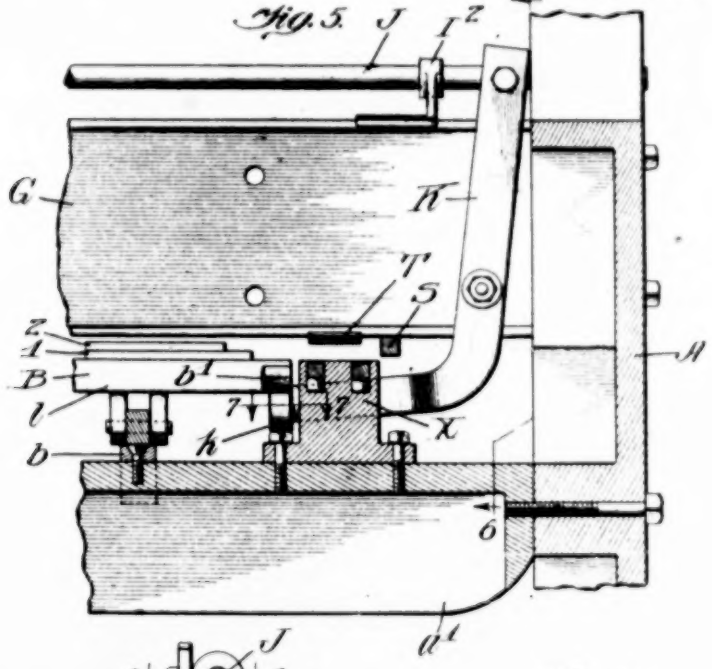


Fig. 6.

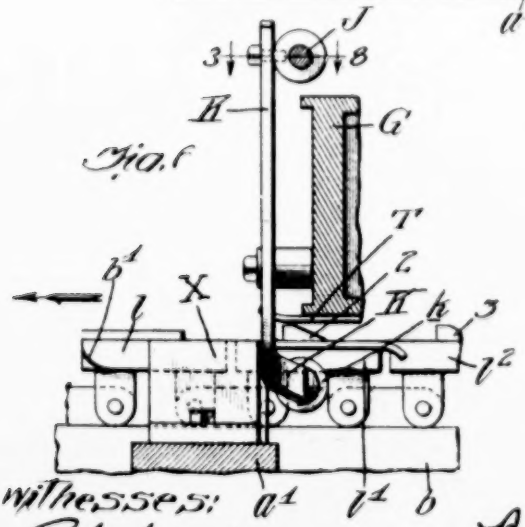


Fig. 7.

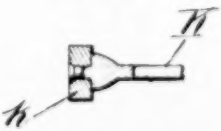
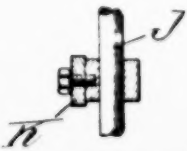


Fig. 8.



Witnesses:
Robert N. Wilkie
A. C. Bird

Inventor:
Edward Craig
By Buckley & Durand
Attys.

1767-1768

E. CRAIG.

BOX BLANK MACHINE.

APPLICATION FILED FEB. 23, 1906. RENEWED DEC. 7, 1914.

1,132,515. Patented Mar. 16, 1915.

6 SHEETS-SHEET 6.

Fig. 10.

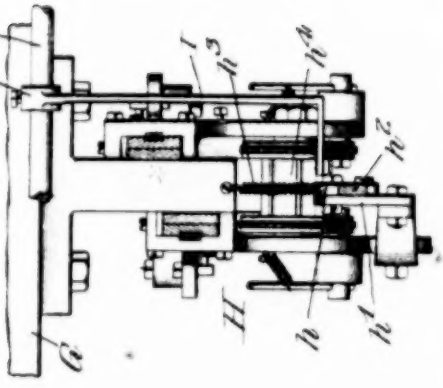


Fig. 11.

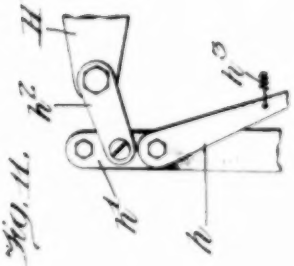
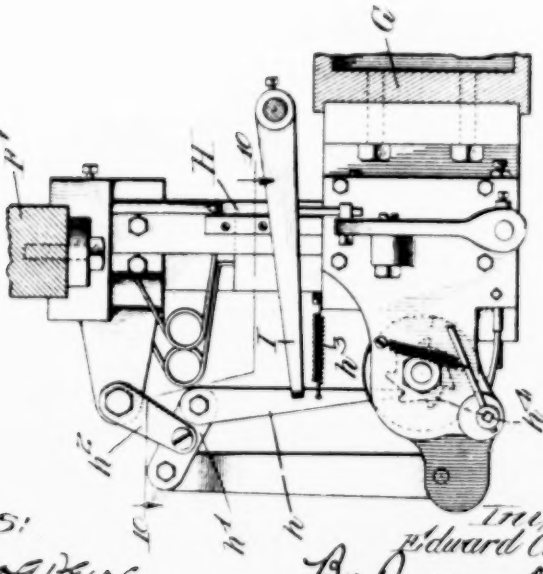


Fig. 9.



Witnesses:
Robert A. Weir
A. L. Bird.

Inventor:
Edward Craig
By Buckley & Durand
Attys

1769-1770

E. CRAIG.

BOX BLANK MACHINE.

APPLICATION FILED FEB. 23, 1906. RENEWED DEC. 7, 1914.

1,132,515. **Patented Mar. 16, 1915.**

7 SHEETS—SHEET 7.

Fig. 14.

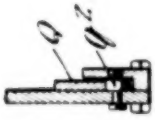


Fig. 15.

Fig. 13.

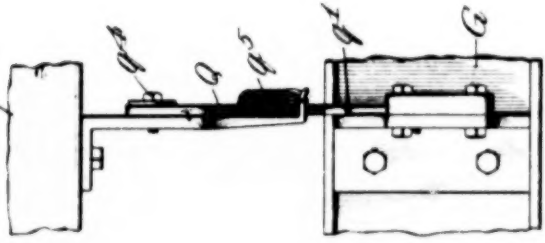
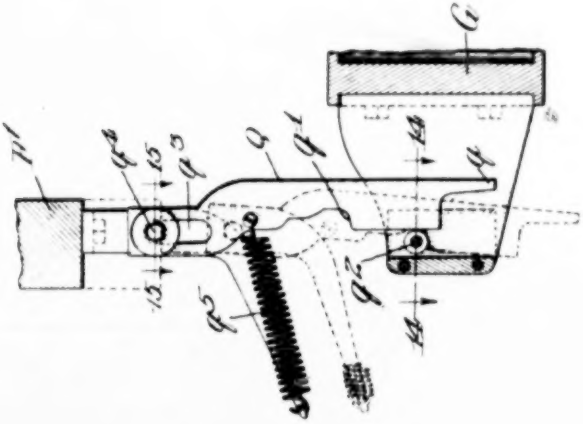


Fig. 12.



Witnesses:
Robert F. Allen
A. L. Bird

Inventor:
Edouard Craig
By Buckley & Durand
Attys.

E. CRAIG.

BOX BLANK MACHINE.

APPLICATION FILED FEB. 23, 1906. RENEWED DEC. 7, 1914.

1,132,515. Patented Mar. 16, 1915.

5 SHEETS—SHEET 3.

Fig. 16.

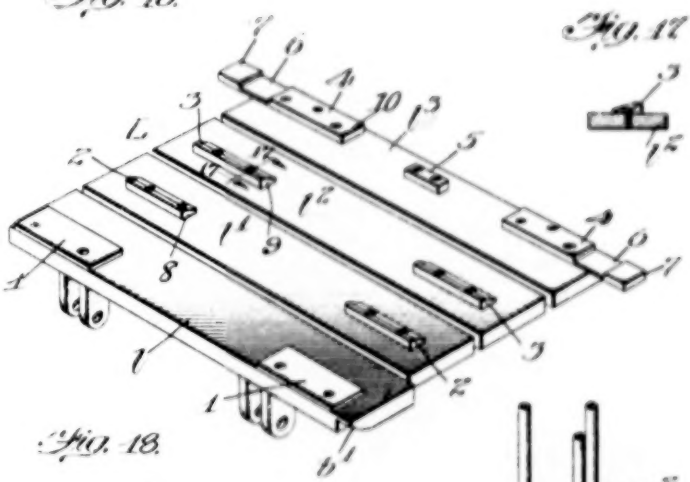


Fig. 17.

Fig. 18.

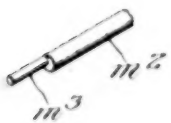


Fig. 19.

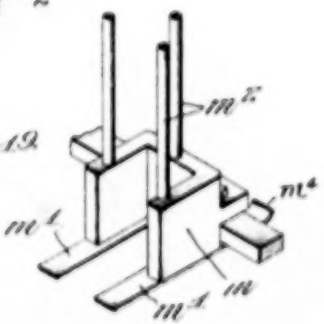
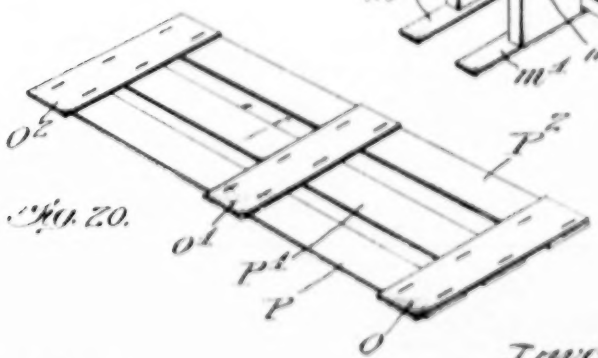


Fig. 20.



Witnesses:
Robert H. Ellis
A. C. Bird

Inventor:
Edward Craig
By Bakewell & Bakewell
Attys.

Generally stated, therefore, the object of my invention is to provide an improved and highly efficient machine for making crate-sides or box blanks or other similar articles.

A special object of my invention is to provide a novel and efficient form of traveling work-holder for feeding the materials forward in properly crossed and spaced relation.

Another object is to provide novel and effective means for automatically feeding the materials to said work holder.

A further object is to provide improved mechanism for preventing the driving of staples between the blanks.

As a matter of further and special improvement, it is also an object to provide novel and effective means for automatically positioning the materials, relative to each other, immediately before being fastened together; and in the arrangement shown and described, embodying the features of my invention, the materials are fed forward to the staplers, but are operated upon by said means, immediately before passing under the staplers, for the purpose of properly spacing or separating certain portions of the materials before they are fastened together; and thus the proper positioning of the materials, or some of them, while traveling forward is of no importance, as they are subject to a positioning operation immediately or some time before receiving the staples.

Another object is to provide a novel and more efficient feed mechanism for feeding the staple wire to the staplers.

A further object is to provide efficient means for compressing the blanks after they have been stapled together, and after they have passed out from under the staplers, for the purpose of insuring flush or smooth surfaces for the blanks, as far as the staples are concerned, thereby preventing the staples from projecting from the surface of the blank, in case the same are not fully clenched when driven, and also insuring a tighter and more effective fastening together of the materials from which the blanks are made.

It is also an object to provide certain details and features of construction and combinations tending to increase the general efficiency and serviceability of a crate or box blank machine of this particular character.

To the foregoing and other useful ends my invention consists in matters hereinafter set forth and claimed.

In the accompanying drawings—Figure 1 is a side elevation of a crate-side machine embodying the principles of my invention. Fig. 2 is an end elevation of the same. Fig. 3 is a plan of the same. Fig. 4 is a longitudinal section on line 4—4 in Fig. 3. Fig. 5 is a detail section on line 5—5 in Fig. 3, on an enlarged scale. Fig. 6 is a vertical section on line 6—6 in Fig. 5. Fig. 7 is a detail sectional view on line 7—7 in Fig. 5. Fig. 8 is a detail section on line 8—8 in Fig. 6. Fig. 9, is an enlarged detail view of one of the three pairs of staplers. Fig. 10 is a section on line 10—10 in Fig. 9. Fig. 11, is a detail view. Fig. 12 is a detail sectional view on line 12—12 in Fig. 2, on a larger scale. Fig. 13, is a side elevation of the mechanism shown in Fig. 12. Fig. 14 is a detail section on line 14—14 in Fig. 12. Fig. 15 is a detail section on line 15—15 in Fig. 12. Fig. 16 is a perspective of one of the sets or formers comprised in the construction of the endless traveling work holder. Fig. 17 is a detail section on line 17—17 in Fig. 16. Fig. 18 is a perspective of the lower end of one of the hopper rods. Fig. 19 is a perspective of the forward end of one of the hoppers for the cross slats. Fig. 20 is a perspective of a finished crate-side.

As thus illustrated, my invention comprises a body [fol. 1774] frame A and an endless traveling work holder B. Said frame has its side portions connected by cross pieces a and a' and strengthened by longitudinal rods a^2. Said work holder is mounted on the sprocket wheels C and C', which latter are carried by the transverse end shafts c and c'. As shown, the work holder comprises two link belts having their links connected and adapted to engage the said sprocket wheels, thus providing a moving bed or table for the work. A drive shaft D is supported in bearings on the frame and provided with a cam d. This cam operates the ratchet wheel E for intermittently advancing the work holder B, as indicated by the arrow in Fig. 4. Said ratchet wheel is secured to the shaft c'. A link or arm e is hung on said shaft and provided with a ratchet dog e' which engages the ratchet wheel. The link or rod e^2 connects the arm e with the lever e^3. This lever is provided with a roll e^4 and pivoted at e^5. A spring e^6 holds the

ratchet dog in normal position, and effects the back stroke of the same. The feed mechanism is so timed and operated that the work holder B is worked along in a step by step manner, and the work properly presented to the staplers. The work is of course always stationary when the staples are actually being inserted. The two link belts or sprocket chains of the work holder run on guides or supports b (one at each side of the machine), and thus the upper portion of the work is held firmly below the hoppers and staplers. A clutch d^1 controlled by a hand lever d^5 is used for starting and stopping the machine. The vertically reciprocating crosshead F is mounted in vertical guides a^3. Cams d' on the shaft D are connected with said cross head by means of straps d^2 and pitmen d^3, the latter being threaded. Said cross heads operate the three pairs of staplers H—H'—H² which can be of any suitable construction. The wire feed mechanism of these staplers is, however, of an improved form. Some parts of the staplers are mounted upon the usual stationary transverse head or beam G; but the feed pawl h, for example, is mounted on a link h' carried by the beam G. A link h^2 connects the middle of the link h' with the cross head. The spring h^3 keeps the pawl pressed normally against the ratchet wheel h^4 of the usual feed rolls. When the cross head moves down the connections cause the pawl h to partially rotate the wire feed rolls and thereby feed the wire to the stapler H. Every fourth stroke, however, the finger I advances and holds the pawl out of operative engagement with the ratchet wheel; and in this way the three successive strokes of the cross-head serve to drive the three sets of staples, but the fourth stroke does not drive any staples, as the feed pawls are all rendered temporarily inoperative every fourth stroke. In this way no staples are driven between the crate-sides, the staplers skipping, so to speak, the spaces between the crate sides on the work holder. These fingers I—I'—I² are all mounted on a transverse and endwise movable rod J which is kept in normal position by a spring j. It will be seen that a pivoted lever K engages the said rod J and has its lower end provided with a roll k adapted to engage the cams b' carried by the work holder B.

Each time a cam engages the lever the rod J shifts and the feed mechanisms of all the staplers are momentarily rendered inoperative, and no staples are driven. After this the staplers drive three sets of staples in succession and thereby fasten together the six slats of the crate-side. Then the staplers skip driving again, as the work holder is moved along one step, and then the next three sets are driven for the next crate-side. This is repeated and the automatic making of the crate-sides continues as long as the machine runs, or as long as the stock of slats in the hoppers lasts.

In Fig. 16 a complete former L is shown, it being understood that the work holder as a whole is made up of a series of these formers. Each former consists of four transverse and link connected sections l—l'—l^2—l^3, the first having the cam b' at one end thereof. The section l is provided with cleats 1; the section l' with cleats 2; the section l^2 with cleats 3; and the last section with cleats 4—4 and 5. The cleats 4—4 each has a transverse recess 6 on the upper surface thereof.

As shown, there are three longitudinal hoppers M—M′—M² for the three transverse slats of the crate-side, and one transverse hopper N for the longitudinal slats of the crate-sides, (see Fig. 3.) The hopper M′, for example, comprises end members m having lower longitudinal ledges m' upon which the slats can rest, so that the lowest or bottom slat is always unobstructed at each end. Immediately upon leaving the hopper N the slats P, P′ and P² are carried under and held down by the ledges or long flat strips m'. Vertical rods m^2 have eccentric lower end portions m^3 which are mounted in the members m. These rods can be rotated to bring their sides flush with the inner surfaces of end members m. The hopper N consists of end members n and a couple of intermediate supports n'—n'. This hopper has vertical rods n^2 like the rods of the other hoppers. The lowest or bottom slat in this hopper N always has its front and rear edges unobstructed. The slats are arranged one on top of the other in all four hoppers. The portions 7—5—7 engage the ends of the three bottom slats in the three hoppers M—M′—M² and push them out upon [fol. 1775] the work holder as the latter moves along. Be-

fore this, however, the cleats 2 have engaged and removed the lowest slat in the hopper N; the cleats 3 have then followed and removed the next slat from the same hopper; and then the cleats 4 remove the next and third long slat of the crate-side. When this is done the three cross slats O—O′—O² of the crate-side are simultaneously discharged onto the ends and middle of the three long slats P—P′—P². It will be understood, of course, that the cleats or projections 2, 3, 4, 5 and 7 can all be of substantially the same height, and that the different hoppers can all be located at the same height or distance above the surface of the work-holder or traveling table. For example, these cleats or projections can be equal in height to twice the thickness of the slats or staves, and the bottom slats or staves in the different hoppers can all be substantially one thickness above the traveling work-holder or table. With this arrangement, the long slat or stave P is brought onto the traveling work-holder by the cleats 2; the next slat or stave P′ is engaged and brought onto the traveling work-holder by the cleats 3; and the last slat or stave P² is then engaged by the cleats or fingers 4, 5 and 7, and thereby discharged from the hopper and brought into place on the traveling work-holder. This, of course, leaves the cleats 5 and 7 extending slightly above the surface of the slat or stave P². Consequently the ends of the lower slats or staves in the three parallel hoppers are then engaged by these cleats 5 and 7, with the result that the said cross slats or relatively short staves O, O′ and O² are discharged crosswise on the three long slats. The cleats 2, 3 and 4 do not engage any of the cross slats, as these cleats travel along between the three parallel hoppers. In this way each former L automatically supplies itself with a full set of slats, and the different sets are carried along, step by step, and each subjected to the action of the staplers. It will be seen that each cross slat receives six staples. In this way the flat rectangular crate-side shown in Fig. 20 is made with rapidity and accuracy. The kickers Q shown in Fig. 12, are operated by the cross-head F, and serve automatically to insure a proper position for each long slat P before it receives the staples. In this way slight disarrangement of the long slats P before the same reach the staplers is recti-

fied by the kickers before the staples are driven. Each kicker has a finger q adapted to engage the rear edges of the long slats; a cam q' adapted, when the cross-head moves down, to engage the roll q^2 on the beam G; a slot q^3 through which extends the supporting bolt q^4, and whereby the kicker stops moving before the cross-head reaches the limit of its downward stroke; and a spring q^5 for keeping the kicker pressed against the roll q^2. When the cams q' reach the rolls q^2 the three kickers snap forward and move the slat P into correct position, thus serving in effect to slightly accelerate the forward movement of some parts of the work immediately before the same is fastened together. The cross slats are guided by spring pressed fingers R—R'—R², as shown in Fig. 3. Also, as will be seen, the three cross-slats are held firmly against the three longitudinal and parallel guides S—S'—S². While going under the stapler the slats are held down by guards T. Before each finished crate-side is discharged from the machine it is subjected to the upward pressure or impact of the transverse jaw U which co-operates with the upper stationary jaw V in fully clenching and flattening all of the staples. This jaw is operated by the levers W which are pivoted, one at each side, at w and engaged by the nuts w'—w' on the pitman d^3. The upper jaw V, has the three anvils v—v'—v^2 as shown in Fig. 2, which are in line with the three cross slats of the crate-side. Below each outer stapler there is a clench block or anvil X. The staples of the middle stapler may clench on the work-holder.

The feed pawls for the staplers are, with the improved arrangement, adapted to move downward for the desired or requisite distance, and to then stop, thus allowing the cross-head to move to the end of its downward stroke without moving the pawls farther, owing to the novel link arrangement.

The friction of the parts, as shown, can be employed to stop the work-holder at the end of each step or stroke. I do not, however, limit myself to any particular means for preventing the work-holder from moving more than a prescribed distance each stroke or step.

The details can, of course, be varied or changed without departing from the spirit of my invention.

It will be seen that my improved machine is in the nature of an assembler for automatically assembling the members of the sides or top of a packing. The long slats or staves P, P′ and P² may be termed "body members," while the cross slats or staves O, O′, and O² may be termed "battens". The hoppers are in the nature of reservoirs or holders for maintaining the said body members or battens in superimposed condition, adapting the same to be discharged one at a time from the bottom thereof.

It will be seen that the work-holder may comprise any suitable number of chains, and that the means for removing the slats from the hoppers can be distributed or located on said chains in any suitable manner. As shown, the ma- [fol. 1776] chine has a receiving end portion where the long slats are placed cross-wise of the work-holder, and the hoppers for automatically delivering the short or cross slats or battens are disposed intermediate the staplers and the said receiving end of the machine. The long hopper at the end of the machine can be used or not, according to requirements, and according to the character of the stock. If the said hopper is not used, then the long slats or body members can be placed by hand on the work-holder, and the short slats or battens will then be automatically delivered on top of the same.

The hoppers for the battens or cross slats are provided with cams m^4 which bear upon the body members or long slats to hold the latter down, after the same have been delivered to the traveling work-holder. There are some additional cams or guards m^5, which are secured to the frame work at each side of the middle hopper M′, and which reach ahead of the other cams so as to press down the middle portions of the said long slats or body members. It will be seen, therefore, that these cams or guards are all interposed between the long hopper and the set of short hoppers, and in this way the said body members or long slats are always pressed down and held flat upon the work-holder just before they pass under the three short hoppers. It will be seen that the portions 5 and 7 first engage a body member or long slat and removed the same from the long hopper; and then after the said cams or guards have pressed the said body member or long slat downwardly upon the work-holder, these portions 5 and 7 then project upwardly above the upper surface of said body member or

slat, thus enabling the said feed blocks 5 and 7 to simultaneously engage three of the battens or cross slats. Thus these feed blocks 5 and 7 are adapted to first engage the long slat or body member, and being of a height substantially equal to the combined thickness of a body member and a cross slat, each block is adapted thereafter to engage the end of a batten or cross slat and remove the same from the bottom of one of the hoppers.

As previously stated the kickers or spacing fingers Q operate to automatically position the long slats or strips of veneer from which the blanks are made, whereby these strips are properly spaced apart before being fastened together. Obviously, however, and by reason of the slot q' which enables the stapler heads to continue moving downward after the kickers or fingers Q have engaged the traveling work-holder, it is possible to skip the slats P'' and P², whereby these two slats will not be subjected to the action of said kickers or fingers. With the arrangement shown, only one of these kickers or fingers Q is employed, (see Fig. 2) this one being disposed immediately at the left of the stapler head H', whereby the end portion q just misses the end 8 of the cleat 2, but comes down upon the end portion 9 of the cleat 3, as well as upon the end portion 10 of the cleat 4 during the operation of the machine. In this way the end portion q of the kicker or finger will move downward and engage the flat top of the traveling work holder at a point somewhere in rear of the slat P, but will not do this with the slats P'' and P², for the reason just stated. In this way, it will be seen that variations in the width of the long slats, which is quite liable to happen in practice, will not cause any variation in the width of the blank—that is to say, the outer edges of the slats P and P² will always be the same distance apart, regardless of variations in the width of the stock from which these slats are made.

When the end portion q strikes the top of the end portion 9 of the cleat 3 the shoulder or cam portion q' does not pass under the roller q^2, and hence the kicker does not swing forward at such time under the tension of the spring q^3: or if it does swing forward, nothing is accomplished, inasmuch as in such case the end of the portion q would simply swing over the slat p', instead of pushing the latter forward. The same is practically true when the end portion q of the kicker or spacing finger comes down on top

of the end portion 10 of the cleat 4, as in such case the slat P^2 is not kicked or shoved forward. In one sense, therefore, the kicker Q, or kickers, if more than one are used, serves or serve to accelerate the forward feeding movement of certain portions of the materials immediately before passing under the staplers. In other words, these materials encounter something in their path of travel which causes them to move forward faster then they are carried by the endless traveling work-holder. Also, it will be seen that the portion q enters the path of the materials and travels a distance therewith, being automatically inserted into and withdrawn from the horizontal plane in which the materials travel forward, whereby the blanks, or the materials of each blank, are successively operated upon by one and the same spacing or positioning device. It is obvious, of course, that several of these kickers Q can be employed if desired. For example, another one can be disposed between the stapler heads H and H', (see Fig. 2) exactly as the one shown is disposed between the middle stapler and the one to the left; and in such case it is obvious that another set of long and short cleats or spacing members would be used, similar to the cleats 2, 3 and 4 at the other side of the work-holder, if it is desired to have all of the [fol. 1777] kickers or positioning devices Q skip the second and third slats P' and P^2 in the manner previously described.

It will also be seen that the cleats 1, 2, 3 and 4 are in the nature of spacing members which, as shown, are in the form of bars extending transversely of the guides S, S', and S^2 by which the binding members O, O' and O^2 of the box or crate blank are held against lateral displacement during their endwise or longitudinal movement with the traveling work support. Means are provided, as previously stated, of any suitable character, depending upon the character of the binding members to be employed, for automatically feeding these longitudinal and parallel binding members upon the sections of sheet material which are properly spaced apart, and which form the body of each blank. It will also be seen that, in a machine constructed and operated in the manner shown and described, rear end portions of the materials are engaged by means carried by the work support, whereby these rear ends are held in alinement transversely of the direction of travel thereof.

In this way the strips O, O' and O² are always exactly opposite each other, and in exact alinement transversely of the direction of travel of the work support, thus insuring a properly shaped box or crate blank. No staples are driven between the blanks, as previously explained, and the mechanism for periodically rendering the feed pawls of the wire feeding devices inoperative is controlled by the traveling motion of the work-holder or work support, preferably by means carried thereon, such, for example, as the cam portions b' previously described. It is obvious, however, that the wheel k, which is in the nature of a detector for finding the space between the blanks, through the medium, in this case, of an indicating cam for each space, may be operated by the motion of the work-holder in any suitable or desired manner. With the arrangement shown, the ends of the blanks overhang the side edges of the work-holder, and these overhanging portions are supported on stationary means, while the staples are being driven, whereby the driving of these staples does not subject the traveling work holder to additional strain. Thus, from the foregoing, it will be seen that means are not only provided for properly feeding longitudinally moving binding members upon the properly spaced sections of sheet material of each blank, in order to connect these sections together, but also for engaging the oncoming materials and subjecting them to a rearrangement or proper relative positioning operation while they are passing by—that is to say, while they are passing the operative position of the means for causing the said readjustment or relative positioning of the materials. In this way the blanks are of the proper length and width when finished, and are also of the proper shape in other respects; and in addition, the making of these blanks is accomplished without wasting any staple wire, inasmuch as no staples are driven between blanks, notwithstanding the fact that this is done without stopping the running of the staplers. In other words, the staplers are given a continuous operation, and reciprocate up and down without stopping; but at the same time the said staplers are rendered inoperative to drive staples at certain places on the traveling work holder, simply by the throwing out of the pawls of the ratchet devices, whereby the wires are not fed into position to be cut off and properly formed into staples.

It will be understood that the said staplers can be of any suitable known or approved character, but are preferably of the well known kind in which each staple is made by automatically feeding a length of wire into position, then cutting off the proper length of said wire, and forming the same into a staple of the proper shape for insertion in the materials.

In the foregoing description, and in the following claims, I have for convenience and description and as a means of identification, referred to the slats O, O' and O², as short slats or members or strips, and for the same purpose have referred to the slats P, P' and P², as long slats or members or strips. It will be understood that I do not limit myself to any particular dimensions or proportions for the crate side.

What I claim as my invention is:

1. In a machine of the class specified, an endless traveling work-holder having means for spacing apart the three long slats of a crate-side, means for holding the three cross slats in place on top of said long slats, and means for causing the work-holder to travel in a direction at right angles to the long slats and parallel with the cross slats.

2. The improved endless traveling work-holder having a plurality of formers each composed of link-connected sections and each provided with means for sustaining a plurality of lower and upper slats in properly spaced and crossed relation with the lower slats extending at right angles to and the upper slats parallel with the direction of travel.

3. In a machine of the class specified, a traveling work-holder provided with means for spacing apart the side and intermediate long slats of a crate-side, means for holding cross slats on top of said long slats, and provisions for automatically and intermittently advancing said work-holder in a direction at right angles to the long slats and parallel with the cross slats.

4. The improved endless traveling work-holder comprising parallel link belts connected by parallel cross-bars to [fol. 1778] provide a flat bed or moving table for the crate-

sides, the ends of said bars serving as connecting links in said link-belts.

5. In a machine of the class specified, the combination of a traveling work-holder, three hoppers for automatically feeding to the work-holder the three cross slats of a crate-side, means for spacing apart the long slats upon which the said cross slats are laid, and means for operating said work-holder.

6. In a machine of the class specified, the combination of a traveling work-holder, hoppers for the cross slats of a crate-side, means on the work-holder for spacing apart the long slats upon which the said cross slats are laid, means on the work-holder for engaging and removing the cross-slats from the hoppers, and means for intermittently advancing said work-holder to intermittently feed the slats from said hoppers.

7. The improved slat hoppers provided with vertical and rotatably and eccentrically mounted rods engaging the ends of the stacks of slats to hold the same in position to be discharged one slat at a time from the bottom of each hopper, substantially as set forth.

8. In a stapling machine, a wire feed consisting of the pawl h, link h' supporting the pawl, operating link h^2 sustaining and actuating the pawl, a ratchet wheel engaged by said pawl, a wire-feeding roller operated by said ratchet wheel, skipping mechanism for throwing said pawl out of operation every fourth stroke thereof to prevent feeding of the wire, means for making and driving the staples, and means for presenting the work.

9. In a machine of the class specified, the combination of means for stapling the crate-sides, and a press for giving the crate-sides a final flattening before discharge from the machine.

10. The improved press comprising the jaw U, anvils x—x'—x^2 above the jaw, levers W for operating said jaw, and pitmen for actuating said levers, substantially as set forth.

11. The improved crate-side machine provided with a plurality of slat delivering gravity-feed hoppers spaced

apart and positioned to feed downwardly a plurality of parallel strips crosswise of a plurality of parallel members, substantially as and for the purpose set forth.

12. A stapler provided with a wire-feeding mechanism comprising a ratched wheel, a pawl for operating said ratchet wheel, and a pivoted link for supporting and limiting the stroke of the pawl, said link and pawl having a toggle, and means for actuating the same.

13. An assembler for assembling the members of a side or top of a package, comprising spaced hoppers in which the body members and battens of a side or top of a package are stacked, an endless carrier traveling beneath the said hoppers and having means for successively removing the members from the said hoppers and placing on a body member a set of spaced battens.

14. An assembler comprising stationary holders for holding body members and battens, and means for feeding the body members and battens from the bottoms of their holders with one superimposed upon the other.

15. An assembler comprising holders for holding the body members and battens at right angles to each other, means for feeding the body members and battens from their holders with the battens superimposed upon the body members, and means for securing the same together in flat form.

16. An assembler comprising holders for holding the body members and battens at right angles to each other, means for feeding a corresponding number of body members and battens from their holders with the battens superimposed upon the body members, and means for securing the same together in flat form.

17. An assembler comprising holders for holding the body members and battens at right angles to each other, and means for feeding the body members from their holders beneath the holders of the battens, and for feeding the battens from their holders superimposed upon the said body members, comprising a work-holder arranged to travel below said holders.

18. In a machine of the class described, the combination with a plurality of stationary reservoirs, of intermittently

operable feeding mechanisms for removing strips of material from the bottoms of the reservoirs, and a securing mechanism to which said strips are presented in properly spaced and crossed relation.

19. An assembler for automatically assembling the members of a side or top of a package, comprising spaced hoppers, one for containing the body members of the package and the other for containing the battens, and traveling devices passing underneath the hoppers for removing successively the members from the hoppers for superimposing the battens on the body members.

20. In a machine of the class described, the combination with an intermittently operable feeding means, of a plurality of strip containing reservoirs, of which one is disposed at a right angle to the others, traveling devices for removing strips from the reservoirs, and maintaining the same in properly spaced relation, and an intermittently operable securing mechanism movable at the completion of each step of the feeding operation.

[fol. 1779] 21. In a machine of the class described, the combination with step by step traveling feeding devices, of strip containing reservoirs from which strips are fed in crossed and spaced relation, a stapling mechanism, and means operable at the completion of each feeding movement to actuate said stapling mechanism for forcing securing staples through the strips.

22. In a machine of the class described, adapted for making crate sides, the combination of a work supporting structure provided with means for holding a plurality of parallel slats with a plurality of parallel cross slats superimposed thereon, hoppers for containing and feeding the cross slats of each crate side, and means for producing relative traveling movement between the said work supporting structure and the said hoppers, to produce the said automatic feeding of slats for each crate side, said work supporting structure being provided with means for engaging the ends of the cross slats and causing a proper discharge thereof from said hoppers.

23. In a machine of the class specified, a traveling work-holder having a receiving end portion, staplers arranged over said work holder, a plurality of hoppers disposed

above and parallel with said work-holder, at a point between the said staplers and the said receiving end portion, feed mechanism for advancing said work-holder, said hoppers adapted to hold slats, said work-holder adapted to carry crosswise thereof the strips received at its receiving end portion, and said work-holder being provided with means for automatically transferring slats from said hoppers onto and crosswise of said strips.

24. In a machine for making crate sides or the like, the combination of means for moving forward a plurality of parallel members extending crosswise of the direction of movement, means including stationary hoppers arranged over the path of travel of said members, for automatically placing a plurality of cross strips on said members, and mechanism for securing the cross strips to the said members.

25. In a machine for making crate sides or the like, the combination of means for holding a plurality of parallel members, automatic mechanism including a plurality of hoppers for discharging downwardly a plurality of cross strips onto said members, and means for securing the cross strips to said members.

26. In a machine for making crate sides or the like, the combination of means including a plurality of gravity feed hoppers for automatically and simultaneously placing in position a plurality of parallel strips, and means for stapling said strips upon and crosswise of parallel members.

27. In a machine for making crate sides or the like, the combination of means including a plurality of gravity feed hoppers for automatically and simultaneously placing in position a plurality of parallel strips, means for effecting a forward movement of said strips in the direction of their length and means for stapling said strips crosswise of other strips.

28. In a machine for making crate sides or the like, a plurality of parallel hoppers for holding slats, an endless traveling structure for carrying parallel members below said hoppers, means for moving said structure in a direction crosswise of said members and parallel with the strips in the hoppers, devices on said structure for automatically and simultaneously transferring a strip from each hopper

on to a set of the said members, and means for stapling the strips to the members.

29. In a machine of the class specified, the combination of a traveling work holder, a plurality of parallel hoppers disposed above and parallel with the direction of travel of said work holder, a hopper disposed above and crosswise of the direction of travel of said work holder, devices on said work holder for removing body strips from the crosswise hopper and reinforcing strips from the parallel hoppers, and mechanisms for effecting the fastening together of said strips.

30. In a machine of the class specified, the combination of a traveling work holder, a plurality of parallel hoppers disposed above and parallel with the direction of travel of said work holder, devices on said work holder for removing reinforcing strips from said hoppers, and mechanisms for effecting a fastening of said strips to body members.

31. In a machine of the class specified, the combination of a traveling work holder, a hopper disposed above and crosswise of said work holder, devices on said work holder for removing body members from said hopper, mechanisms for effecting a fastening of reinforcing strips to the said body members, and means on said work holder for engaging the ends of said strips to space the same apart.

32. In a machine of the class specified, adapted for making box blanks, the combination of a traveling work holder, a plurality of parallel gravity feed hoppers disposed above the plane of the said work holder, means for causing relative motion between said hoppers and the work holder in the direction of the length of said hoppers, a hopper disposed above the plane of the work holder and crosswise of the direction of said relative movement, devices for removing body strips from the crosswise hopper and reinforcing strips from the parallel hoppers, during the said relative [fol. 1780] motion, and mechanisms for effecting the fastening together of the three automatically fed strips to form the blank.

33. In a machine of the class specified, adapted for making box blanks, the combination of a traveling work holder, a plurality of parallel gravity feed hoppers disposed above the plane of said work holder, means for causing relative

motion between said hoppers and work holder, in the direction of the length of said hoppers, devices for removing reinforcing strips from said hoppers, during the said relative motion, and instrumentalities for effecting the securing of the said strips to the blank.

34. In a machine of the class specified, adapted for making box blanks, the combination of a suitable work holder, a gravity feed hopper disposed above and crosswise of the plane of said work holder, means for causing relative motion between said hopper and work holder, in a direction crosswise of said hopper, devices for removing body members from said hopper, during the said relative motion, instrumentalities for effecting a fastening of reinforcing strips to said body members, and means on said work holder for ejecting the said blank therefrom.

35. In a machine of the class described, a supporting frame, a strip containing reservoir arranged transversely of the frame, a plurality of batten containing reservoirs arranged longitudinally of the frame, an endless feed chain, a feed block carried thereby and of a height approximately equal to the thickness of one of the strips and one of the battens, said block being arranged to first engage with a batten in one of the battens and a strip arranged beyond the strip reservoir for engaging and depressing said strip to engage the batten bearing movement.

36. In a machine of the class described, a frame, a strip containing reservoir disposed transversely thereof, a plurality of batten containing reservoirs arranged longitudinally of the frame, a plurality of endless feed belts, feed blocks carried thereby at intervals, and each of a height approximately equal to the thickness of a strip and a batten, a feed chain arranged between the transverse reservoir and the longitudinal reservoirs for depressing the strip to permit the upper portion of the feed blocks to engage with and remove the battens from the reservoirs.

37. In a machine of the class specified, adapted for making box blanks, the combination of a suitable work holder, said work holder being of such width that the ends of the box blanks project beyond and overhang the sides thereof, as set forth, a plurality of parallel gravity feed hoppers disposed above the plane of the said work holder, means

41. In a crate side machine, a work-holder for retaining transverse strips in place with parallel reinforcing members on top thereof, a hopper for holding said strips, means for causing relative movement between said hopper and work-holder, in a direction longitudinal of said reinforcing members, to automatically feed the said body strips into position on the work-holder, and means for driving fastening devices to secure the said members and strips [fol. 1781] together, with the former crosswise of the latter.

42. In a crate side machine, a traveling work-holder for supporting reinforcing members and body strips in position, which body strips are of uniform length, means for operating said work-holder to carry the said members and strips forward in a horizontal plane, a hopper for holding and automatically feeding the body strips, by the forward movement of the work-holder, and means for securing the members and strips together, with said members uppermost.

43. In a crate side machine, means for supporting reinforcing members and body strips, which body strips are of uniform length, means for propelling the said parts along in flat or blank form in a straight path lengthwise of said reinforcing members, a hopper holding and feeding the body strips, by the action of the propelling means, and means for stapling the members and strips together, with the said members uppermost.

44. In a crate side machine, a work table upon which parallel rows of reinforcing members are supported and to and for movement in the parallel direction thereof, with body strips of uniform length crosswise of said parallel rows, means for propelling said assembled parts in the direction of said rows of reinforcing members, a hopper for holding and automatically feeding the said body strips, by the motion of said work table, and means for stapling the said members and strips together, said hopper extending crosswise of said parallel rows.

45. In a crate side machine, means for supporting reinforcing members and body strips, which body strips are of uniform length, means for propelling the said parts along in flat or blank form in a straight path lengthwise of said reinforcing members, having provisions for engaging the

ends of said reinforcing members, a hopper for holding and feeding the body strips, by the action of the propelling means, and means for stapling the members and strips together, with said members uppermost.

46. In a crate side machine, a work table upon which straight parallel rows of reinforcing members are supported end to end for movement in the parallel direction thereof, with body strips of uniform length crosswise of said parallel rows, means for propelling said assembled parts along in flat or blank form in the direction of said rows of reinforcing members, having provisions for engaging the ends of the latter, a hopper for holding and automatically feeding the said body strips, by the action of the propelling means, and means for stapling the said members and strips together, with said members uppermost.

47. In a crate side machine, a work holder for retaining parallel reinforcing members in place, a hopper for holding body strips, and means for causing relative movement between said hopper and work holder, in a direction longitudinal of said reinforcing members, to automatically feed the said body strips into position on the work holder, and means for driving fastening devices to secure the said reinforcing members and body strips together, with the former crosswise of the latter, and means on said work holder for engaging the ends of said members to space them apart endwise.

48. In a crate side machine, a traveling work holder for supporting reinforcing members and body strips in position, which body strips are of uniform length, a hopper for holding and feeding the body strips, by the action of the work holder, means for securing the members and strips together, said work holder having means for engaging said reinforcing members to space and hold the same in position, and means for preventing displacement of said strips laterally of the path of travel thereof.

49. In a crate side machine, means for supporting reinforcing members and body strips, which body strips are of uniform length, means for propelling the said parts along in a direction lengthwise of said reinforcing members, having provisions for engagement with the latter, a hopper for

holding and feeding the body strips crosswise of said direction, by the action of said propelling means, means for stapling the members and strips together, and means for preventing displacement of said strips laterally of the path of travel thereof.

50. A crate or box blank machine comprising a traveling mechanism for supporting and moving the blank materials in properly spaced and crossed relation in a horizontal plane, and with longitudinal reinforcing members on top thereof means for stapling the material together, by inserting the staples in straight rows through an upper layer of thin material and into a body of suitable material below, means for supporting said mechanism for movement in a straight line, and a hopper for holding some of said materials subject to the action of said mechanism, whereby the operation of said mechanism automatically feeds the contents of said hopper into place on said mechanism.

51. A crate or box blank machine comprising a mechanism for holding and moving the blank materials in properly crossed relation, by motion along a straight line in a horizontal plane, and with longitudinal reinforcing members on top thereof, means for stapling the materials together, by inserting the staples in straight rows through an upper layer of thin material and into a body of suitable material below, and a hopper holding some of said materials subject to the action of said mechanism, whereby the operation of [fol. 1782] said mechanism automatically feeds the contents of said hopper to said mechanism.

52. An assembler comprising holders for holding the body members and battens at right angles to each other, means for feeding the body members and battens from their holders, with the battens superimposed upon the body members, means for securing the same together in flat form, and mechanism for accelerating the forward movement of some parts of the work immediately before the same is fastened together.

53. In a machine of the class specified, a traveling work holder having a receiving end portion, staplers arranged over said work holder, a plurality of hoppers disposed above and parallel with said work holder, at a point between the said staplers and the said receiving end portion,

feed mechanism for advancing said work holder, said hopper adapted to hold slats, said work holder adapted to carry crosswise thereof the strips located at its receiving end portion, said work holder being provided with means for automatically transferring slats from said hoppers onto and crosswise of said strips, and mechanism for accelerating the forward movement of some parts of the work immediately before the same is fastened together.

54. In a machine for making crate sides or the like, the combination of means for holding a plurality of parallel members, automatic mechanism including a plurality of hoppers for discharging downwardly a plurality of cross-strips onto said members, means for feeding the cross-strips to said members, and mechanism for accelerating the forward movement of some parts of the work immediately before the same is fastened together.

55. In a machine for making crate sides or the like, the combination of means including a plurality of gravity feed hoppers for automatically and simultaneously depositing in position a plurality of parallel strips, means for effecting a forward movement of said strips in the direction of their length, means for shaping said strips crosswise thereof, means for applying cross-strips to said strips, and mechanism for accelerating the forward movement of some parts of the work immediately before the same is fastened together.

56. A crate or box blank machine comprising a [illegible] mechanism for supporting and moving the blank material in properly spaced and parallel relation in a horizontal plane, means for shaping the material transversely, means for applying the cross-strips to the material, means for supporting said material in a straight line, a hopper for holding cross-strips and subject to the action of said mechanism, means for the operation of said mechanism intermittently, means for feeding said hopper into place for said mechanism, and mechanism for accelerating the forward movement of some parts of the work immediately before the same is fastened together.

57. A crate or box blank machine comprising a mechanism for holding and moving the blank material in properly

crossed relation, by motion along a straight line in a horizontal plane, means for stapling the materials together, by inserting the staples in straight rows through an upper layer of thin material and into a body of suitable material below, a hopper holding some of said materials subject to the action of said mechanism, whereby the operation of said mechanism automatically feeds the contents of said hopper to said mechanism, and mechanism for accelerating the forward movement of some parts of the work immediately before the same is fastened together.

38. An assembler comprising holders for holding the body members and battens at right angles to each other, means for feeding the body members and battens from their holders with the battens superimposed upon the body members, means for securing the same together in that form, and spring controlled guide fingers for engaging the edges of certain parts of the work to keep the same in position.

39. In a machine of the class specified, a traveling work holder having a receiving end portion, staplers arranged over said work holder, a plurality of hoppers disposed above and parallel with said work holders, at a point between the said staplers and the said receiving end portion, feed mechanism for advancing said work holder, said hoppers adapted to hold slats, said work holder adapted to have crosswise thereof the strips received at its receiving end portion, said work holder being provided with means for automatically transferring slats from said hoppers onto said strips of said strips, and spring controlled guide fingers for engaging the edges of certain parts of the work to keep the same in position.

40. In a machine for making crate sides or the like, the combination of means for holding a plurality of parallel members, automatic mechanism including a plurality of hoppers for discharging downwardly a plurality of cross strips onto said members, means for securing the cross strips to said members, and spring controlled guide fingers for engaging the edges of certain parts of the work to keep the same in position.

41. In a machine for making crate sides or the like, the combination of means including a plurality of gravity feed hoppers for automatically and simultaneously

placing in position a plurality of parallel strips, means for effecting a forward movement of said strips in the direction of their length, means for stapling said strips crosswise of other strips, and spring-controlled guide fingers for engaging the edges of certain parts of the work to keep the same in position.

62. A crate or box blank machine comprising a traveling mechanism for supporting and moving the blank materials in properly spaced and crossed relation, in a horizontal plane, means for stapling the materials together, by inserting the staples in straight rows through an upper layer of thin material and into body of suitable material below, means for supporting said mechanism for movement in a straight line, a hopper for holding some of said materials subject to the action of said mechanism, whereby the operation of said mechanism automatically feeds the contents of said hopper into place on said mechanism, and spring controlled guide fingers for engaging the edges of certain parts of the work to keep the same in position, laterally of the path of travel thereof.

63. A crate or box blank machine comprising a mechanism for holding and moving the blank materials in properly crossed relation, by motion along a straight line in a horizontal plane, means for stapling the materials together, by inserting the staples in straight rows through an upper layer of thin material and into a body of suitable material below, a hopper holding some of said materials subject to the action of said mechanism, whereby the operation of said mechanism automatically feeds the contents of said hopper to said mechanism, and spring-controlled guide fingers for engaging the edges of certain parts of the work to keep the same in position, laterally of the path of travel thereof.

64. In a box or crate blank machine, the combination of means for causing body strips and reinforcing members to move along in a direction crosswise of the body strips, staples for securing the said strips and members together, and mechanism for additionally moving the strips forward before they pass under the staplers.

65. A box or crate machine comprising staplers, means for driving the materials forward to the staplers, and

mechanism for engaging and automatically changing the relative positions of the materials, while they are moving along and before they are stapled together.

66. A box or crate blank machine comprising staplers, means for feeding the assembled materials under the staplers, and mechanism for re-adjusting some of the materials before they are stapled together, disposed in position to regulate the same while they are moving along.

67. A box or crate blank machine comprising staplers, means for causing the materials to move forward to the staplers, and mechanism for automatically producing a correct spacing of the materials before they are stapled together, disposed in such position that the blanks are successively engaged thereby.

68. A box or crate blank machine comprising staplers, means for driving the materials forward to the staplers, and mechanism for automatically changing the relative positions of the materials before they are stapled together, said mechanism having an entering portion which engages the blank between edges of the veneer of each blank and moves a distance therewith, and means for moving said portion into and out of the path of the materials.

69. A box or crate blank machine comprising staplers, means for feeding the assembled materials under the staplers, and mechanism for re-adjusting some of the materials before they are stapled together, said mechanism having a portion which engages the blanks between edges of the veneer of each blank and moves a distance therewith.

70. A box or crate blank machine comprising staplers, means for causing the materials to move forward to the staplers, and mechanism for automatically producing a correct spacing of the materials before they are stapled together, said mechanism having a portion which engages between edges of the veneer of each blank and moves a distance therewith, the said portion being separate and distinct from said means.

71. A box or crate blank machine comprising staplers, means for driving the materials forward to the staplers, and mechanism for automatically changing the relative

position of the materials before they are stapled together, disposed in position to perform successive operations on the materials, said mechanism including a finger that engages the materials of each balnk and moves a distance therewith.

72. A box or crate blank machine comprising staplers, means for feeding the assembled materials under the staplers, and mechanism for re-adjusting some of the materials before they are stapled together, said mechanism including a finger that engages the materials of each blank and moves a distance therewith.

73. A box crate or blank machine comprising staplers, means for causing the materials to move forward to the staplers, and mechanism for automatically spacing the ma- [fol. 1784] terials before they are stapled together, by successive operations thereon, said mechanism including a finger that successively engages the materials of each and every blank and moves a distance therewith.

74. A machine for making box or crate blanks, comprising a traveling work-holder having means for holding a plurality of long members in parallel and spaced relation, means for positioning a plurality of short members on top of said long members, crosswise thereof, to form a crate side with openings therein, means for automatically operating said work holder, thereby causing all of said members to move forward together, and means for stapling the short members upon the long members, by a plurality of successive operations on each blank.

75. A machine for making box or crate blanks, comprising a traveling work-holder having means for holding a plurality of long members in parallel and spaced relation, means for positioning a plurality of short members on top of said members, crosswise thereof, to form a crate side with openings therein, means for automatically operating said work-holder, thereby causing all of said members to move forward together, and means for stapling the short members upon the long members, by a plurality of successive operations on each blank, said work-holder traveling in the direction of said short members.

76. A machine for making box and crate blanks, comprising a traveling work-holder having means for position-

ing a plurality of short members, means for holding a plurality of long members in parallel and spaced relation crosswise of said short members, to form a crate side with openings therein, means for automatically operating said short work holder, means whereby said members are held against displacement, and means for stapling the long and short members together, by successive operations on each blank, said operations alternating with the actuations of the work holder.

77. A machine for making box and crate blanks, comprising a traveling work holder having means for positioning a plurality of short members, means for holding a plurality of long members in parallel and spaced relation crosswise of said short members, to form a crate side with openings therein, means for automatically operating said work holder, means whereby said members are held against displacement, and means for stapling the long and short members together, by successive operations on each blank, said work holder traveling in the direction of said short members.

78. A machine for making box or crate blanks, comprising stapling and work feeding instrumentalities coöperating to fasten the blank materials together by a plurality of successive stapling operations on each blank, and mechanism disposed in position to engage the oncoming materials for automatically determining the proper relation of the materials to each other before the same are fastened together.

79. A machine for making box or crate blanks, comprising stapling and work feed instrumentalities coöperating to fasten the blank materials together by a pluraility of successive stapling operations on each blank, and mechanism disposed in position to engage the oncoming materials, for automatically determining the relation of the mamaterials before the same are fastened together, including a positioning device movable into and out of the path of said materials to establish correct spaces in said blanks.

80. A machine for making box or crate blanks, comprising stapling and work feeding instrumentalities coöperating to fasten the blank materials together by plurality of

82. A machine for making box or crate blanks, comprising stapling and work feeding instrumentalities cooperating to fasten the blank materials together by a plurality of successive stapling operations on each blank, and mechanism disposed in position to engage the oncoming materials, for automatically determining the relation of the materials before the same are fastened together, said mechanism operating to produce relative movement of said materials.

83. A machine for making box or crate blanks, comprising stapling and work feeding instrumentalities cooperating to fasten the blank materials together by a plurality of successive stapling operations on each blank, and mecha- [Ind. 17851] nism disposed in position to engage the oncoming materials, for automatically determining the relation of the materials before the same are fastened together, including a positioning device movable into and out of the path of said materials to establish correct spaces in said blanks, said mechanism operating to produce relative movement of said materials.

84. A machine for making box or crate blanks, comprising automatic stapling and work feeding devices cooperating to fasten the blank materials together, and mechanism for automatically preventing the driving of staples between blanks, including a wire feed pawl, and means for automatically throwing said pawl out of action when a space between blanks passes under the stapling device.

85. A machine for making box or crate blanks, comprising automatic stapling and work feeding devices cooperating to fasten the blank materials together, and mechanism for automatically preventing the driving of staples between blanks, controlled by the forward feeding motion of the devices which produce the feeding motion of said materials.

86. A machine for making box or crate blanks, comprising wire feeding and stapling and work feeding devices cooperating to fasten the blank materials together, and mechanism for automatically preventing the driving of staples between blanks, having provisions for interrupting the wire feeding device, to prevent the formation of staples without stopping the running of the stapling device.

87. A machine for making box or crate blanks, comprising automatic stapling and work feeding devices cooperating to fasten the blank materials together, and mechanism for automatically preventing the driving of staples between blanks, together with means for relatively positioning the parts of each blank before being stapled together, disposed in position to engage the oncoming materials of each blank.

88. A machine for making box or crate blanks, comprising automatic stapling and work feeding devices cooperating to fasten the blank materials together, and mechanism for automatically preventing the driving of staples between blanks, together with means movable into and out of the path of the materials, and traveling a slight distance therewith for producing correct spacing in each blank.

89. A box blank machine comprising staplers, means for feeding the blank materials to the staplers, and automatically governed mechanism for controlling said staplers without interrupting the running thereof to prevent the driving of staples between the blanks.

9. A box blank machine comprising staplers, parallel guides, means for feeding the materials along said guides, said means and guides cooperating to present the materials to said staplers in superimposed and crossed relation, means for actuating said staplers to secure the materials together by a plurality of successive operations for each blank, said feeding means having provisions whereby the blank is formed with spaces at intervals in the direction of travel thereof, and for positioning the proper materials on those below, said machine having a pivoted member for each guide, and springs for yieldingly holding said members in the path of the endwise traveling materials.

blank is formed with spaces at intervals in the direction of travel thereof, and for positioning the upper materials on those below, said machine having automatic mechanism for preventing the driving of staples between blanks, and means for automatically controlling said mechanism by the motion of said feeding means.

94. A machine for making box blanks by securing the sheet material to parallel strips, comprising guides for [fol. 1796] said strips, means for securing the sheet material to the strips by a plurality of successive fastening operations for each blank, instrumentalities for causing the sheet material and strips to have a step by step feeding motion relative to said means, cooperating with said guides to cause the strips to travel endwise one behind the other in parallel rows, devices for relatively positioning the sheet material and strips before the fastening together thereof, structural elements for supporting said devices in position to operate adjacent the path of travel of said material and strips, and mechanism for intermittently actuating said means.

95. A machine for making box blanks by securing the sheet material to parallel strips, comprising guides for said strips, means for securing the sheet material to the strips by a plurality of successive fastening operations for each blank, instrumentalities for causing the sheet material and strips to have a step by step feeding motion relative to said means, cooperating with said guides to cause the strips to travel endwise one behind the other in parallel rows, devices for relatively positioning the sheet material and strips before the fastening together thereof, structural elements for supporting said devices in position to operate adjacent the path of travel of said sheet material and strips, and mechanism for intermittently actuating said means, said devices including means for engaging the strips to correctly position them relative to each other, and also including means for engaging edges of the sheet material and movable a distance therewith in the direction of travel thereof.

96. A machine for making box blanks by securing the sheet material to parallel strips, comprising guides for said strips, means for securing the sheet material to the strips by a plurality of successive fastening operations for each blank, instrumentalities for causing the sheet material and

strips to have a step by step feeding motion relative to said means, cooperating with said guides to cause the strips to travel endwise one behind the other in parallel rows, devices for relatively positioning the sheet material and strips before the fastening together thereof, structural elements for supporting said devices in position to operate adjacent the path of travel of said material and strips, and mechanism for intermittently actuating said means, said devices including a strip engaging member for each guide, having an axis of movement relative thereto, and also including means insertible into the path of the sheet material, movable a distance in the direction of travel thereof and then returnable to position for another operation.

97. A machine for making box blanks by securing the sheet material to parallel strips, comprising guides for said strips, means for securing the sheet material to the strips by a plurality of successive fastening operations for each blank, instrumentalities for causing the sheet material and strips to have a step by step feeding motion relative to said means, cooperating with said guides to cause the strips to travel endwise one behind the other in parallel rows, devices for relatively positioning the sheet material and strips before the fastening together thereof, structural elements for supporting said devices in position to operate adjacent the path of travel of said material and strips, and mechanism for intermittently actuating said means, said devices including means for engaging edges of the sheet material, to relatively position said edges, movable into and out of the plane of said material, and being also supported to move a distance with the sheets before disengaging therefrom.

98. A box blank machine comprising an endless traveling structure for feeding the blank materials forward, means mounted on said structure for spacing the successive sections of sheet material of each blank, serving also to push the sheet material forward with said structure, by engagement with the rear edge of each section, means for supplying parallel binding members upon said sheet material, longitudinally of said structure, fastener driving mechanism for securing said members to the sheet material, by successive operations on each blank, thereby

successively connecting together the sections of the blank, means disposed on said traveling structure for pushing forward on the rear ends of portions of said blank materials, said ends and edges being disposed in different parallel planes, and means for causing said structure to have a step by step feeding motion.

99. A box blank machine comprising an endless traveling structure for feeding the blank materials forward, means mounted on said structure for spacing the successive sections of sheet material of each blank, serving also to push the sheet material forward with said structure, by engagement with the rear edge of each section, means for supplying parallel binding members upon said sheet material, longitudinally of said structure, fastener-driving mechanism for securing said members to the sheet material, by successive operations on each blank, thereby successively connecting together the sections of the blank, means disposed on said traveling structure for pushing forward on the rear ends of portions of said blank materials, said ends and edges being disposed in different parallel planes, and means for causing said structure to have a step by step feeding [fol. 1787] motion, the said machine being arranged to have both inside and outside lateral engagement with the materials to prevent displacement of said portions from the path of travel thereof.

100. A box blank machine comprising an endless traveling structure for feeding the blank materials forward, means mounted on said structure for spacing the successive sections of sheet material of each blank, serving also to push the sheet material forward with said structure, by engagement with the rear edge of each section, means for supplying parallel binding members upon said sheet material, longitudinally of said structure, fastener driving mechanism for securing said members to the sheet material, by successive operations on each blank, thereby successively connecting together the sections of the blank, means disposed on said traveling structure for pushing forward on the rear ends of portions of said blank materials, said ends and edges being disposed in different parallel planes, and means for causing said structure to have a step by step feeding motion, the said machine having automatic means for preventing the driving of fasteners between the blanks.

165. A box blank machine comprising an endless traveling structure for feeding the blank materials forward, means mounted on said structure for spacing the successive sections of sheet material of each blank, serving also to push the sheet material forward with said structure, by engagement with the rear edge of each section, means for supplying parallel binding members upon said sheet material longitudinally of said structure, fastener driving mechanism for securing said members to the sheet material, by successive operations on each blank, thereby successively connecting together the sections of the blank, means disposed on said traveling structure for pushing forward on the rear ends of portions of said blank materials, said ends and edges being disposed in different parallel planes, and means for causing said structure to have a step by step feeding motion, the said machine having means for automatically supplying the sheet material to said work support.

166. A box blank machine comprising an endless traveling structure for feeding the blank materials forward, means mounted on said structure for spacing the successive sections of sheet material of each blank, serving also to push the sheet material forward with said structure, by engagement with the rear edge of each section, means for supplying parallel binding members upon said sheet material, longitudinally of said structure, fastener driving mechanism for securing said members to the sheet material, by successive operations on each blank, thereby successively connecting together the sections of the blank, means disposed on said traveling structure for pushing forward on the rear ends of portions of said blank materials, said ends and edges being disposed in different parallel planes, and means for causing said structure to have a step by step feeding motion, the said machine having automatic means for relatively positioning the materials before they are fastened together.

165. A box blank machine comprising an endless traveling structure for feeding the blank materials forward, means mounted on said structure for spacing the successive sections of sheet material of each blank, serving also to push the sheet material forward with said structure, by engagement with the rear edge of each sec-

[fol. 1788]

tion, means for supplying parallel binding members upon said sheet material, longitudinally of said structure, fastener driving mechanism for securing said members to the sheet material, by successive operations on each blank, thereby successively connecting together the sections of the blank, means disposed on said traveling structure for pushing forward on the rear ends of portions of said blank materials, said ends and edges being disposed in different parallel planes, and means for causing said structure to have a step by step feeding motion, the said machine having automatic means for adjusting and correcting the relative positions of some of said materials before they are fastened together.

106. A machine for making box or crate blanks, comprising a traveling work-holder having means for holding a plurality of long members in parallel and spaced relation, means for positioning a plurality of short members on top of said long members, crosswise thereof, to form a crate side with openings therein, means for automatically operating said work-holder, means for stapling the short members upon the long members, by a plurality of successive operations on each blank, guides for holding the endwise moving members against lateral displacement, and stationary means across which the blanks are carried by said work-holder and upon which the end portions of each blank are supported while being stapled.

107. A machine for making box or crate blanks, comprising a traveling work-holder having means for holding a plurality of long members in parallel and spaced relation, means for positioning a plurality of short members on top of said long members, crosswise thereof, to form a crate side with openings therein, means for automatically operating said work-holder, means for stapling the short members upon the long members, by a plurality of successive operations on each blank, said work-holder traveling in the direction of said short members, guides for holding the endwise moving members against lateral displacement, and stationary means across which the blanks are carried by said work holder and upon which the end portions of each blank are supported while being stapled.

108. A machine for making box and crate blanks, comprising a traveling work-holder having means for positioning a plurality of short members, means for holding a plurality of long members in parallel and spaced relation crosswise of said short members, to form a crate side with openings therein, means for automatically operating said work-holder, means for stapling the long and short members together, by successive operations on each blank, guides for holding the endwise moving members against lateral displacement, and stationary means across which the blanks are carried by said work holder and upon which the end portions of each blank are supported while being stapled.

109. A machine for making box crate blanks, comprising a traveling work-holder having means for positioning a plurality of short members, means for holding a plurality of long members in parallel and spaced relation crosswise of said short members, to form a crate side with openings therein, means for automatically operating said work-holder, means for stapling the long and short members together, by successive operations on each blank, said work-holder traveling in the direction of said short members, guides for holding the endwise moving members against lateral displacement, and stationary means across which the blanks are carried by said workholder and upon which the end portions of each blank are supported while being stapled.

110. A machine for making box or crate blanks, comprising a traveling work-holder having means for holding a plurality of sheet members in parallel and spaced relation, means for positioning a plurality of flat members on top of said sheet members, crosswise thereof, to form a crate side with openings therein, means for automatically operating said work-holder a plurality of times for each blank, thereby causing all of said members to move forward together, and means for stapling the flat members upon the sheet members by a plurality of successive operations on each blank.

111. A machine for making box and crate blanks, comprising a traveling work-holder having means for positioning a plurality of flat members, means for holding a

plurality of sheet members in parallel and spaced relation crosswise of said flat members, to form a crate side with openings therein, means for automatically operating said work-holder a plurality of times for each blank, means whereby said members are held against displacement, and means for stapling the sheet and flat members together by successive operations on each blank, said operations alternating with the actuations of the work-holder.

112. A machine for making box or crate blanks, comprising a traveling work-holder having means to support the blanks, devices on said work-holder to position sheet material in a plurality of superimposed layers thereon, mechanism for operating said work-holder a plurality of times [fols. 1789 & 1790] for each blank, staples disposed in position to operate on said blanks, and means for operating said staplers a plurality of times for each blank to drive the staples in straight rows extending in the direction of travel of said blanks, said devices being arranged to position a plurality of flat strips in parallel and spaced relation for one said layer.

113. A machine for making box or crate blanks, comprising a traveling work-holder having means to support the blanks, devices on said work-holder to position sheet material in a plurality of superimposed layers thereon, mechanism for operating said work-holder a plurality of times for each blank, staplers disposed in position to operate on said blanks, and means for operating said staplers a plurality of times for each blank to drive the staples in straight rows extending in the direction of travel of said blanks, said devices being arranged to position a plurality of flat strips in parallel and spaced relation for one said layer, and said work-holder and devices being constructed to receive and support said strips upon the other layer.

114. A machine for making box or crate blanks, comprising a traveling work-holder having means to support the blanks, devices on said work-holder to position sheet material in a plurality of superimposed layers thereon, mechanism for operating said work-holder a plurality of times for each blank, staplers disposed in position to operate on said blanks, and means for operating said staplers a plurality of times for each blank to drive the staples in

E. CRAIG.

BOX AND PROCESS OF MANUFACTURE THEREOF.

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Fig 1

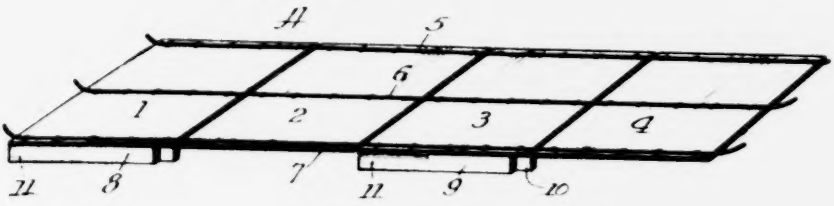


Fig. 2.

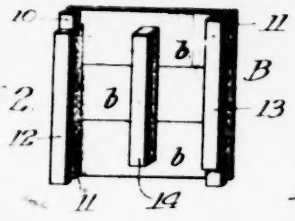


Fig. 3.

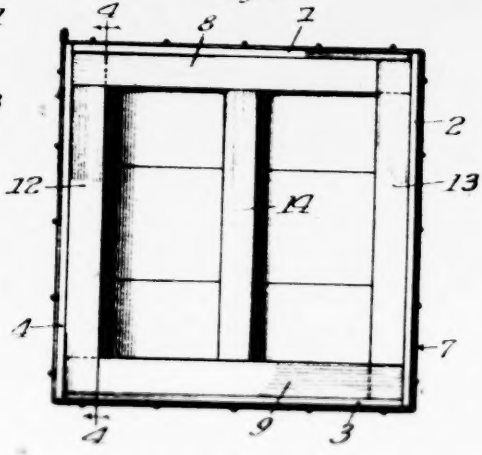
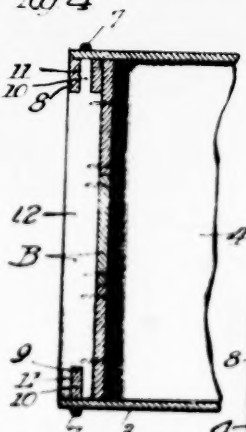


Fig 4



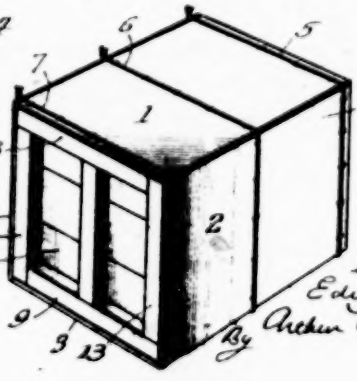


Fig. 5.

Witnesses:

Arthur W. Carlson

Maurice Goesberger

Inventor

Edward Craig

By Archer L. Fornault

Atty.

straight rows extending in the direction of travel of said blanks, said devices being arranged to position a plurality of flat strips in parallel and spaced relation for one said layer, and said work-holder being supported for feeding movement longitudinally of said strips.

Signed by me at Chicago, Ill., this 6th day of February, 1906.

Edward Craig.

Witnesses: A. F. Durand, F. H. Drury.

(Here follow side folios 1791 & 1792.)

[fol. 1793] United States Patent Office

Edward Craig, of St. Joseph, Michigan

Box and Process of Manufacture Thereof

1,208,297. Specification of Letters Patent. Patented Dec. 12, 1916

Application filed April 24, 1916. Serial No. 93,066

To all whom it may concern:

Be it known that I, Edward Craig, a citizen of the United States of America, and resident of St. Joseph, Berrien county, Michigan, have invented a certain new and useful Improvement in Boxes and Processes of Manufacture Thereof, of which the following is a specification.

My invention relates to boxes of that kind in which the four sides are secured to rectangular end-walls, and in which means are provided for reinforcing the ends of the box along the edges thereof, as by providing the same with cleats and binding-wires, such as the ordinary or well-known wire-bound boxes.

Generally stated, the object of my invention is to provide an improved construction and arrangement, and an improved or novel process of manufacture, whereby some of the cleats are first fastened to one or more sections of the box-blank, while other cleats are fastened to the end-walls, and whereby the box-blank thus partially reinforced by cleats can then be folded around the end-walls which are

also partially reinforced by cleats, and whereby the cleats of the box-blank can then be fastened to the end walls, so that the cleats which are first fastened to the end-walls can afterward be fastened to the sections of the blank which were not provided with cleats, thus making it possible to have the end-walls reinforced by cleats before they are fastened to the box-blank, which is especially advantageous when each end-wall is composed of two or more separate strips of sheet-material, and thereby making it possible to have the cleats of the box-blank of such length that the opopsite ends of each cleat are even with the edges of the sheet-material to which they are attached, which is also advantageous in various ways, as will hereinafter more fully appear.

It is also an object to provide an improved construction and arrangement and process of manufacture which will obviate the necessity of using certain features of construction and methods and machines heretofore considered necessary or desirable in the manufacture of boxes of this class.

To the foregoing and other useful ends, my invention consists in matters hereinafter set forth and claimed.

In the accompanying drawings: Figure 1 is a perspective of a box-blank embodying the principles of my invention. Fig. 2 is a perspective of a box-end embodying the principles of my invention. Fig. 3 is an end view of a box constructed in accordance with my invention. Fig. 4 is a vertical section on line 4—4 in Fig. 3. Fig. 5 is a perspective of said box.

As thus illustrated, my invention comprises a box-blank A having four box-side-sections 1, 2, 3 and 4 which are flexibly connected together by the parallel binding-wires 5, 6 and 7 secured to the outer surface thereof by staples. On its inner surface said box-blank is reinforced at the side edges thereof by cleats 8 and 9 secured, respectively, to the sections 1 and 3, so that each of these sections is provided with a cleat at each side-edge of the blank. These cleats are each provided at opposite ends with a tongue 10 and a groove 11, and the ends of these cleats are exactly even with the edges of the sections 1 and 3, it being understood that all of these box-side-sections are made of veneer or other sheet-material. The staples which hold the

wires 5 and 7 in place serve also to secure the cleats 8 and 9 to the under or inner side of the blank.

Each box-end-wall B is provided at two edges thereof with cleats 12 and 13, and at the center with a shorter cleat 14, the latter having blunt ends, but the cleats 12 and 13 being provided with a tongue-and-groove formation previously described. With this construction, the end-wall may be composed of two or more separate sheets *b* of veneer or other sheet-material, inasmuch as the cleats 12, 13 and 14, or at least the cleat 14, will serve as battens or binding-members to hold the several strips tightly together before these end-walls are incorporated in the box.

The method of combining the box-blank with the end-walls is as follows: The cleats 8 are adjusted in position to interlock with the cleats 12 and 13, and the section 2 is then folded flatwise against the cleats 13, after which the section 3 is folded to bring the cleats 9 into interlocking engagement with the lower ends of the cleats 12 and 13, as shown in Fig. 3, thus forming a rectangular box with an open cover. The cleats 8 and 9 are then fastened by staples or nails, or in any suitable manner, to the sheet-material of the end-walls, and the cleats 12 and 13 are fastened by staples or nails to the sheet-material of the sections 2 and 4 [fol. 1794] of the blank, but the section 4 is, of course, not thus fastened in place until after the box is filled, as this section forms the box-cover. The opposite ends of the wires 5, 6 and 7 are then twisted together, in the manner shown, to form three practically continuous binding-members around the box.

With the foregoing construction, the edges of sections 2 and 4 overlap the edges of section 1 and 3, as shown in Fig. 3, thus forming tight corners for the box, notwithstanding that the ends of the cleats 8 and 9 are even or flush with the edges of the sections 1 and 3. As some of the cleats are fastened to the end-walls before the latter are incorporated in the box, it follows, that the mere folding of the blank around the end-walls serves to hold the latter in place, as the cleats on the end-walls interlock with those on the blank, thus making it possible to easily and conveniently handle and manipulate the box before and during the operation of stapling or nailing the end-walls to the cleats of the blank, as well as while fastening the blank to the cleats of the end-walls. The staples for the wires 5, 6 and 7 may be clenched

on the under or inner surface of the box-side sections 2 and 4 in any suitable manner. Thus some cleats are fastened to one or more but not all of the sections of the box blank, while one or more of the box-blank-sections are not provided with cleats. This results in a blank which is easily folded, and which can only fold in the correct manner. As the center cleats 14 are usually necessary in boxes of this kind, it is very easy and requires practically no more time to fasten the cleats 12 and 13 to the box-end during the same operation, so that the three cleats are secured in place at the same time.

With the foregoing construction, it is also obvious that the foldable-blank and the end-walls can be combined without any stapling or nailing—that is to say, the blank can be folded around the end walls, and the box can then be filled, without having stapled or nailed the end-walls in place, and the ends of the binding-wires can then be twisted together. Thus, the box can be shipped in a knocked-down condition, can be assembled and filled without any stapling or nailing, the twisting of the ends of the binding-wires together constituting the only means for holding the box in shape. In this way after the box is opened and the contents thereof are removed, the blank and the end-walls can then be knocked down and returned in a flat condition. Thus a flexible blank is made by securing the parallel binding members to the outside thereof, to flexibly connect together the several box-side sections, and parallel rows of cleats; are secured to the inside of the blank, but with gaps left in said rows, whereby the blank is only partially cleat reinforced before it is secured to the other cleats which are thereafter used to fill said gaps in the rows. Preferably, these gaps are opposite each other, as shown, and preferably the cleats 12 and 13 are secured to the end walls B before these cleats are used for filling in the gaps left in the rows of cleats on the blank; but for the broader purposes of my invention I do not, of course, limit myself to the exact construction, nor to the exact method or process shown and described.

What I claim as my invention is:

1. A foldable box-blank comprising a plurality of box-side-sections composed of sheet-material and flexibly connected together by binding-members extending parallel on the outer surface of the blank and beyond the end thereof

and having only one but not all of said box side-sections provided with cleats on the inner surface of the box-blank.

2. A foldable box-blank comprising a plurality of box-side-sections composed of sheet-material and flexibly connected together by binding-members extending parallel on the outer surface thereof and having some but not all of said box-side-sections provided with cleats on the inner surface of the box-blank, said cleat-reinforced-box-side-sections being two in number, and there being the same number of box-side-sections which are not thus reinforced, and said cleats having their opposite ends even with the edges of the sheet-material.

3. A foldable box-blank comprising a plurality of box-side-sections composed of sheet-material and flexibly connected together by binding-members extending parallel on the outer surface thereof and having some but not all of said box-side-sections provided with cleats on the inner surface of the box-blank, said cleat-reinforced box-side-sections being two in number, and there being the same number of box-side-sections which are not thus reinforced, and said cleats having their opposite ends even with the edges of the sheet-material, said box-side-sections being spaced apart to allow the edges thereof to overlap at the corners of the box in the manner shown and described.

4. Means to form a cleat-reinforced-box, comprising a foldable blank having only two of the box-side-sections thereof reinforced by cleats, and box-ends having cleats for attachment to the box-side-sections which are not thus reinforced.

5. Means to form a cleat-reinforced-box, comprising a foldable blank having only two of the box-side-sections thereof reinforced by cleats, and box-ends having cleats for attachment to the box-side-sections which are not thus reinforced, said box-side-sections comprising sheet-material the [fol. 1795] edges of which are even with the opposite ends of said cleats thereof, and said box-ends comprising sheet-material the edges of which are flush with the ends and outer sides of the cleats secured thereto.

6. Means to form a cleat-reinforced-box, comprising a foldable blank having only two of the box-side-sections

thereof reinforced by cleats, and box-ends having cleats for attachment to the box-side sections which are not thus reinforced, said box-side sections being separate and provided with binding-wires by which they are flexibly connected together.

7. The process of making a box having cleats at the ends thereof, which comprises the making of a flexible blank by connecting together the sections thereof and securing some of said cleats thereto, leaving one or more sections of the blank without cleats, making box-ends by securing the remaining cleats thereto so that each box-end is provided with cleats only at certain edges thereof, folding the blank around said box-ends, securing the cleats of the blank to said box-ends and securing the cleats of the box-ends to said blank.

8. The process of making a box, which comprises the making of a flexible blank by connecting together the sections the reof and securing some of said cleats thereto, leaving one or more sections of the blank without cleats, making box-ends by securing the remaining cleats thereto so that each box-end is provided with cleats only at certain edges thereof, folding the blank around said box-ends, securing the cleats of the blank to said box-ends, and securing the cleats of the box-ends to said blank, the making of the blank including the attachment of binding-wires to flexibly connect together the previously unconnected sections thereof.

9. The process of making a box, which comprises the making of a flexible blank by connecting together the sections thereof and securing some of said cleats thereto, leaving one or more sections of the blank without cleats, making box-ends by securing the remaining cleats thereto so that each box-end is provided with cleats only at certain edges thereof, folding the blank around said box-ends, securing the cleats of the blank to said box-ends, and securing the cleats of the box-ends to said blank, the making of the blank involving the separation of the edges of the sections and the positioning of the opposite ends of the cleats thereof even with some of said edges.

10. A box-end having cleats disposed on the outer surface thereof and secured thereto at opposite edges only,

flush with said edges, and having spaces between the ends of said cleats at the other edges thereof.

11. A box-end having cleats secured thereto at opposite edges only, having spaces between the ends of said cleats at the other edges thereof, and four box-side-sections two of which have cleats to occupy said spaces and the other two of which are adapted for attachment to the cleats on the box-end.

12. A box-end having cleats secured thereto at opposite edges only, having spaces between the ends of said cleats at the other edges thereof, and four box-side-sections two of which have cleats to occupy said spaces and the other two of which are adapted for attachment to the cleats on the box-end, said cleats having ends which are even with the edges of the box-end, and a shorter cleat in the middle of the box-end.

13. The process of making a box having cleats at the ends thereof, which comprises the making of a flexible blank by connecting together the sections thereof and securing some of said cleats thereto, leaving one or more sections of the blank without cleats, making box-ends by securing the remaining cleats thereto so that each box-end is provided with cleats only at certain edges thereof, folding the blank around said box-ends, causing the cleats of the blank to alternate with and engage the cleats of the box-ends.

14. Means to form a cleat-reinforced-box comprising a foldable blank having the box-side-sections thereof reinforced by parallel longitudinal rows of cleats, with gaps in said rows, and box-ends having cleats to fill the gaps in said rows.

15. Means to form a cleat-reinforced-box comprising a foldable blank having the box-side-sections thereof reinforced by parallel longitudinal rows of cleats, with gaps in said rows, and box-ends having cleats to fill the gaps in said rows, said cleats being formed with tongue-and-groove ends to interlock and thereby hold said box-ends in place.

16. The process of making a box having cleats at the ends thereof, which comprises the making of a flexible blank by connecting together the sections thereof and se-

curing some of said cleats thereto, making box-ends by securing the remaining cleats thereto so that each box-end is provided with cleats only at certain edges thereof, folding the blank around said box-ends, securing the cleats of the blank to said box-ends, and securing the cleats of the box-ends to said blank.

17. The process of making a box having cleats at the ends thereof, which comprises the making of a flexible blank by connecting together the sections thereof and securing some of said cleats thereto, making box-ends by securing the remaining cleats thereto so that each box-end is provided with cleats only at certain edges thereof, folding the blank around said box-ends, causing the cleats of the blank [fol. 1796] to alternate with and engage the cleats of the box-ends.

18. The process of making a wire bound box having cleats at the ends thereof, which comprises the making of a flexible blank by securing parallel continuous binding wires to the outside of the box-side-sections, to flexibly connect the sections together and provide the encircling wire binding for the box, and securing some of said cleats to the inside of the blank, thereby forming parallel rows of cleats with gaps therein, and thereafter securing the remaining cleats in said gaps and closing the ends of the box with end walls.

19. Means to form a cleat-reinforced-box comprising a foldable blank having the box-side-sections thereof reinforced by parallel longitudinal rows of cleats, with gaps in said rows, and end-walls to close the ends of the box and other cleats to fill the gaps in said rows.

Signed by me at Chicago, Illinois, this 22nd day of April, 1916.

Edward Craig.

Correction in Letters Patent No. 1,208,297

It is hereby certified that in Letters Patent No. 1,208,297, granted December 12, 1916, upon the application of Edward Craig, of St. Joseph, Michigan, for an improvement in "Boxes and Processes of Manufacture Thereof," an error appears in the printed specification requiring correction as follows: Page 2, line 84, claim 1, after the word "one"

E. CRAIG & W. H. RAY.

WIRE BOUND CRATE SIDE MACHINE.

APPLICATION FILED MAR. 20, 1912.

1,254,779.

Patented Jan. 29, 1918.

7 SHEETS—SHEET 1.

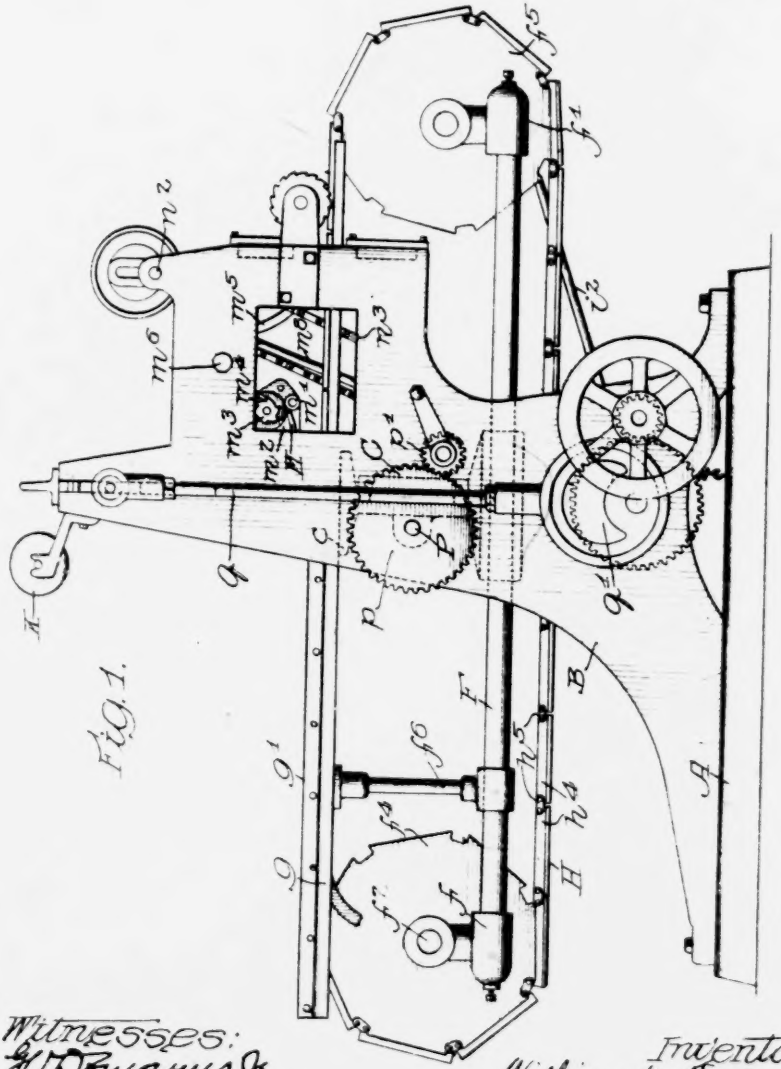


FIG. 1.

Witnesses:
C. Romanus Jr.
R. Burkhardt.

Inventor
William H. Ray
Edmund Craig
By Arthur F. Durand
Atty

E. CRAIG & W. H. RAY.

WIRE BOUND CRATE SIDE MACHINE.

APPLICATION FILED MAR. 20, 1912.

1,254,779.

Patented Jan. 29, 1918.

7 SHEETS—SHEET 2.

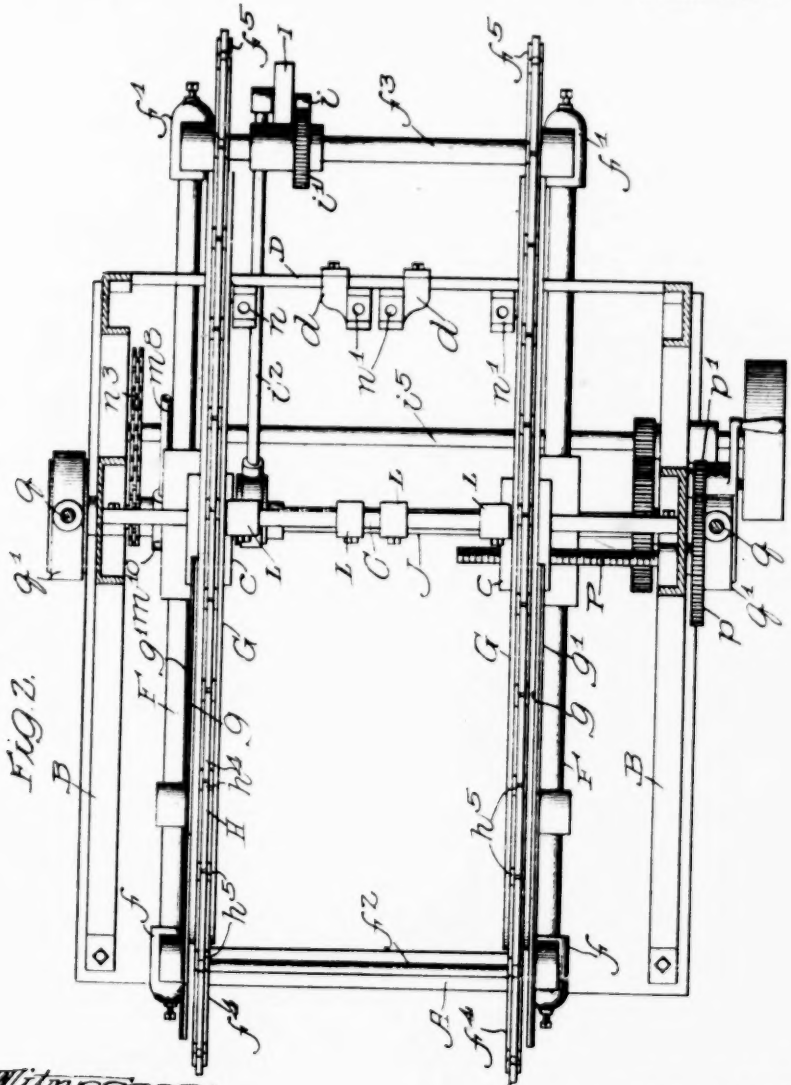


FIG. 2.

Witnesses:
G. F. Duarya Jr.
R. Burkhardt.

Inventor
William H. Ray
Edward Craig
By Arthur H. Dunbar
Atty

E. CRAIG & W. H. RAY.

WIRE BOUND CRATE SIDE MACHINE.

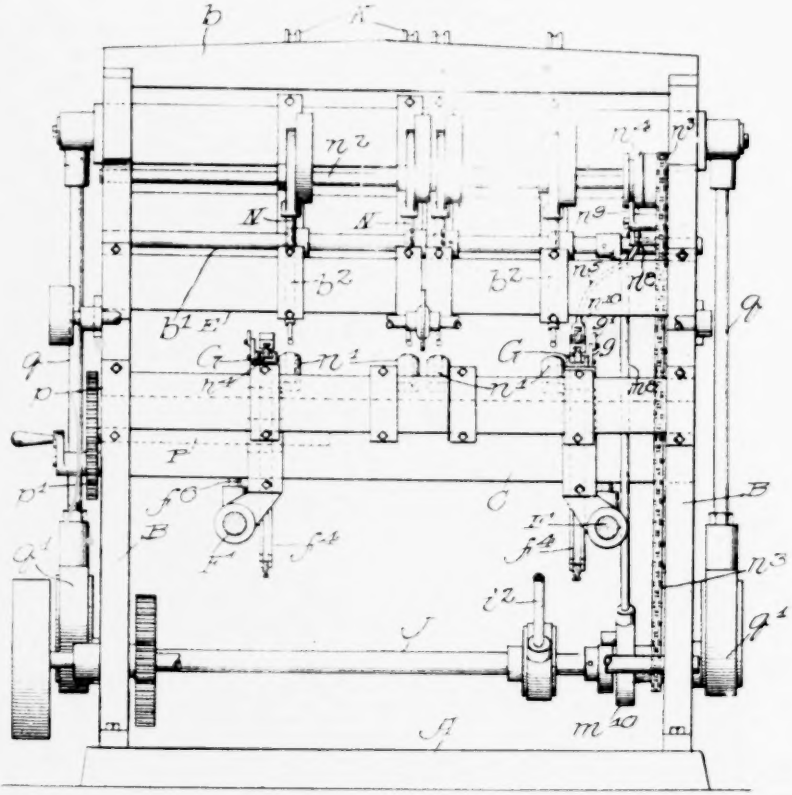
APPLICATION FILED MAR. 20, 1912.

1,254,779.

Patented Jan. 29, 1918.

7 SHEETS—SHEET 3.

Fig 3.



Witnesses:
E. K. Ewarus Jr.
P. Burkhardt

Inventor
William H. Ray
Edward Craig
By Arthur L. Durand
Atty.

E. CRAIG & W. H. RAY.

WIRE BOUND CRATE SIDE MACHINE.

APPLICATION FILED MAR 20, 1912.

1,254,779.

Patented Jan. 29, 1918.

7 SHEETS—SHEET 4.

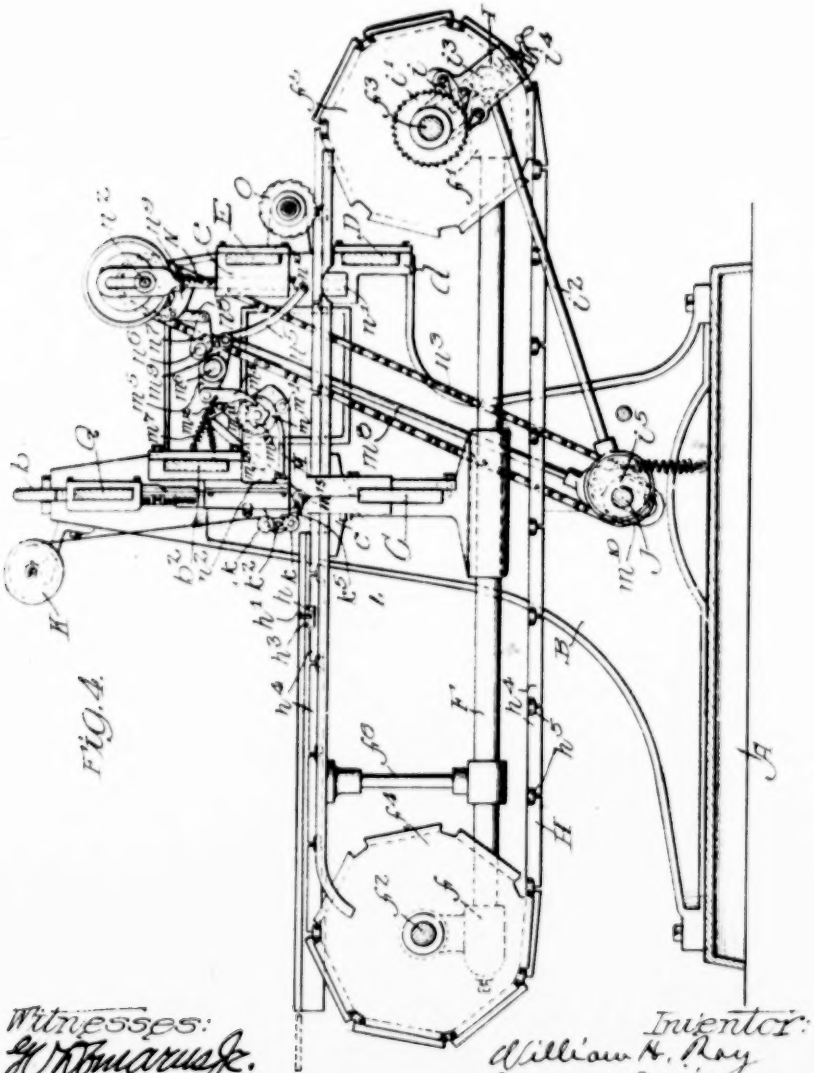


FIG. 4.

Witnesses:
H. C. Edwards Jr.
P. Burkhardt

Inventor:
William H. Ray
Edward Craig
By Arthur H. Durand
Atty

1805-1806

E. CRAIG & W. H. RAY.

WIRE BOUND CRATE SIDE MACHINE.

APPLICATION FILED MAR 20, 1912.

1,254,779.

Patented Jan. 29, 1918.

7 SHEETS—SHEET 5.

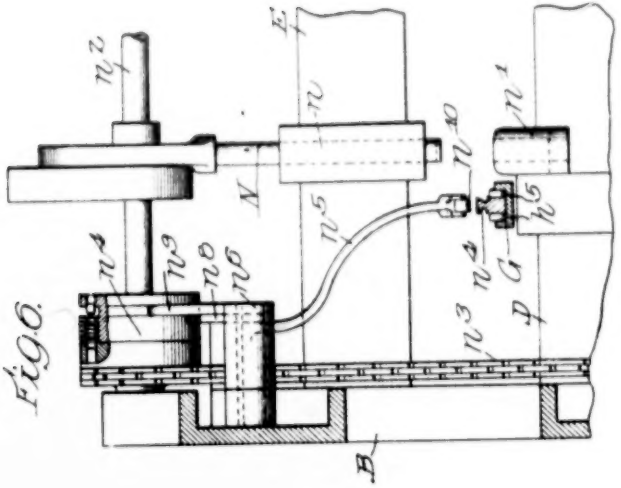


Fig. 6.

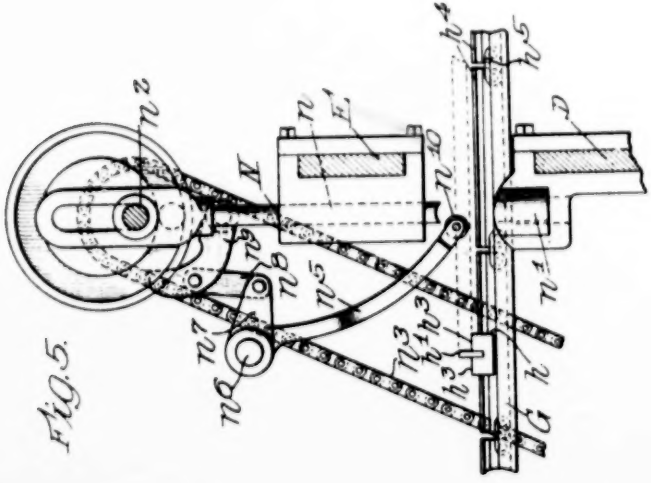


Fig. 5.

Witnesses:
H. D. Bomarus Jr.
R. Burkhardt

Inventor:
William H. Ray
Edward Craig
By Arthur H. Dunwell
Atty.

E. CRAIG & W. H. RAY.

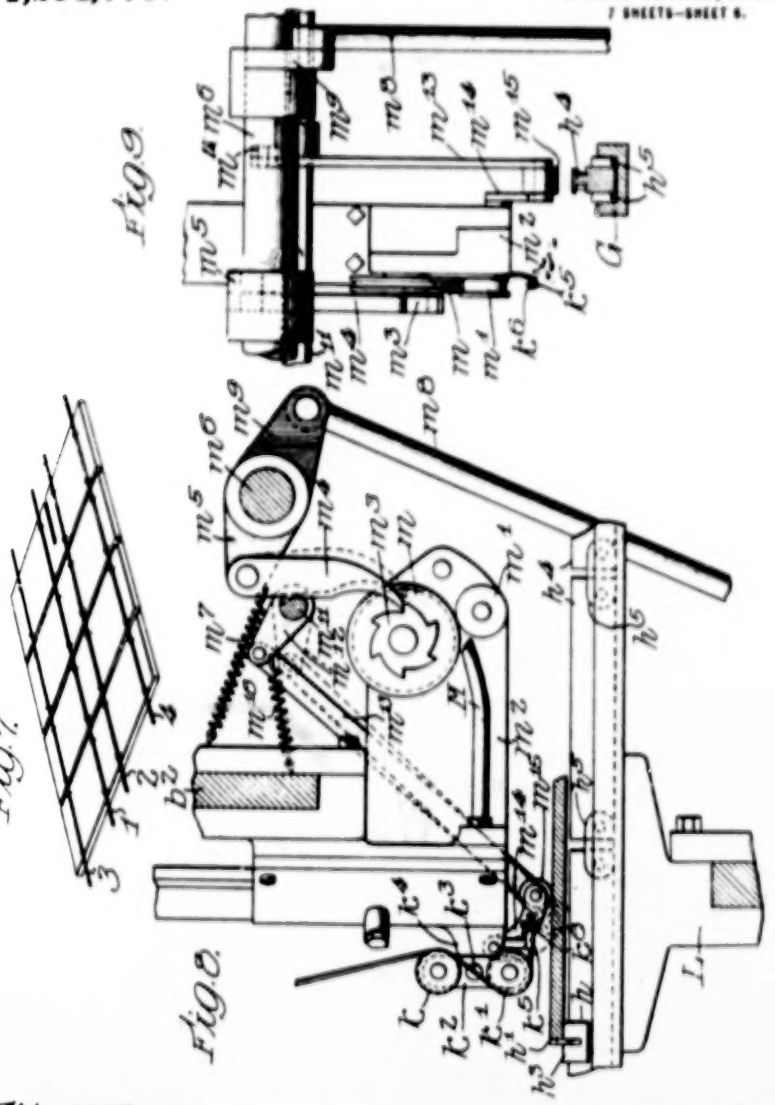
WIRE BOUND CRATE SIDE MACHINE.

APPLICATION FILED MAR. 20, 1912.

1,254,779.

Patented Jan. 29, 1918.

7 SHEETS—SHEET 6.



Witnesses:
H. C. Edwards Jr.
R. Burkhardt.

Inventor
William H. Ray
Edmund Craig
by Alan L. Sinclair Atty.

E. CRAIG & W. H. RAY.

WIRE BOUND CRATE SIDE MACHINE.

APPLICATION FILED MAR. 20, 1912.

1,254,779.

Patented Jan. 29, 1918.

7 SHEETS—SHEET 7.

Fig. 10.

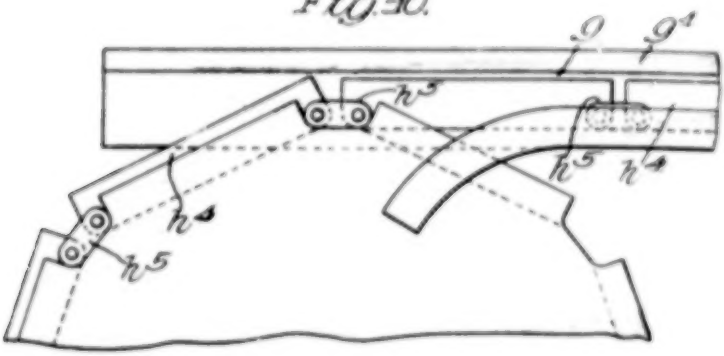


Fig. 11.

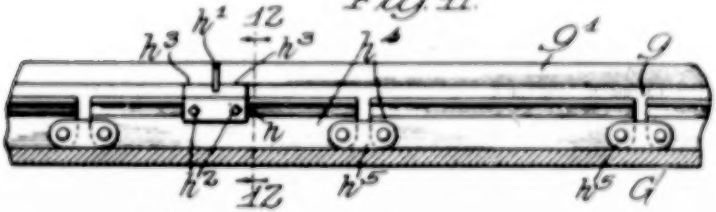


Fig. 12.

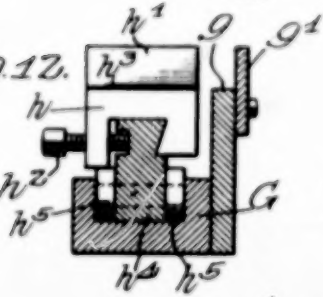


Fig. 13.

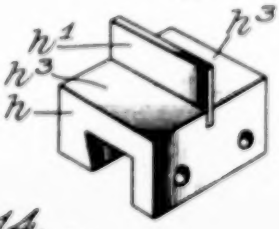


Fig. 14.

Witnesses:
H. K. Edwards Jr.
P. Burkhardt.

Inventor.
William H. Ray.
Edward Craig
by Arthur F. Jerrold
Atty.

insert the words *or more*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 6th day of February, A. D., 1917.

R. F. Whitehead, Acting Commissioner of Patents.

(Seal.)

Cl. 217—12.

(Here follow side folios 1797-1810.)

[fol. 1811] United States Patent Office

Edward Craig and William H. Ray, of St. Joseph, Michigan

Wire-bound-crate-side Machine

1,254,779. Specification of Letters Patent. Patented Jan. 29, 1918

Application Filed March 20, 1912. Serial No. 684,971

To all whom it may concern:

Be it known that we, Edward Craig and William H. Ray, citizens of the United States, and residents of St. Joseph, Berrien county, Michigan, have invented certain new and useful Improvements in Wire-Bound-Crate-Side Machines, of which the following is a specification.

Our invention relates to machinery for stapling materials. It relates more particularly to machinery for making box blanks, and especially those adapted for applying parallel binding wires to veneer or other sheet material.

An object of our invention is to provide a simple and efficient machine for applying parallel binding wires, or their equivalent, or similar reinforcing members, to strips of veneer or other sheet material.

Another object is to provide a machine of this kind in which simple and effective means are provided for preventing the driving of staples between the ends of adjacent blanks.

Another object is to provide a machine of this kind having simple and effective means for automatically cutting

the wire or other binding members between the ends of adjacent blanks.

Another object is to provide a machine of this kind in which effective means are provided for tensioning the binding wires, and for exerting pressure thereon to hold the same in place by friction when the wires are cut, and whereby the said binding wires are prevented from becoming disarranged relative to the staplers.

Another object is to provide a machine of this kind in which simple and improved means are provided for operating the feed mechanism by which the staple wires are fed to the staplers.

It is also an object to provide certain details and features of improvement tending to increase the general efficiency and serviceability of a machine of this particular character, and whereby the use of certain features of construction and methods of manufacture heretofore considered necessary or desirable is avoided.

To the foregoing and other useful ends our invention consists in matters hereinafter set forth and claimed.

In the accompanying drawings:

Figure 1, is a side elevation of an automatic wiring machine embodying the principles of our invention.

Fig. 2, is a plan of the said machine.

Fig. 3, is a rear end elevation of the said machine, with certain portions thereof shown in vertical section, and certain other parts broken away for convenience of illustration.

Fig. 4, is a longitudinal section of said machine.

Fig. 5, is an enlarged detail view of the mechanism for automatically cutting or severing the binding wires between the ends of adjacent blanks.

Fig. 6, is a front elevation of the mechanism shown in Fig. 5.

Fig. 7, is a perspective of one of the large blanks made by a machine embodying the principles of our invention, showing the same partially cut or severed at one end, which cutting or severing operation is for the purpose of dividing this large or double blank into two relatively small blanks, it being easier and more economical to make two blanks this way, and by practically one and the same operation, than by making the two small blanks successively,

or by making two such small blanks in separate and independent machines.

Fig. 8, is an enlarged detail side elevation of one of the stapling heads, showing the staple wire feed mechanism, and showing also the mechanism by which this wire feed mechanism is automatically controlled by the traveling movement of the endless work holder, or by the traveling movement of the work itself.

Fig. 9, is a rear elevation of the mechanism shown in Fig. 8.

Fig. 10, is an enlarged side elevation of one of the sprocket wheels for the work holder, showing the adjacent portion of the said sprocket chain or work holder, and showing also a portion of the means for guiding the stock.

Fig. 11, is a side elevation of a portion of one of the [fol. 1812] sprocket chains, showing the support or guide therefor in longitudinal section.

Fig. 12, is an enlarged section on the line 12—12 in Fig. 11.

Fig. 13, is a perspective of one of the spacing blocks employed on the said sprocket chains of the said endless traveling work holder.

Fig. 14, is a perspective of one of the guiding tubes employed on the staplers, which tubes guide the staple wires, each tube being provided with a spring which exerts pressure downwardly upon the wire to produce sufficient friction to prevent the wire from slipping out of the guide when it is automatically cut or severed at a point farther on by the means for so doing.

As thus illustrated, our invention comprises a base A upon which are mounted the two upright castings or side frames B by which the various operative parts of the machine are supported in suitably elevated positions. These side frames are connected at their upper ends by a rigid cross bar b, and at a point lower down by the usual bar b^1 upon which the staplers b^2, of any suitable character, are supported in the usual manner, and are adapted for lateral adjustment when it is desired to change or vary the width of the blanks.

As shown, there are four of these staplers, and the middle staplers are disposed close together to apply the middle two wires 1 and 2 of the blank shown in Fig 7, this

being a double blank The outer staplers apply the wires 3 and 4 of said blank. The side frames B are also connected by the cross bars C and D, which bar C is provided with adjustable brackets c. A cross bar E connects the two frames at a point above the bar D. The round bars F are held in the brackets c, and are provided at their ends with brackets f f', which serve as bearings for the shafts f^2 f^3 upon which are mounted the sprocket wheels f^4 f^5 these bars being disposed horizontally and longitudinally of the machine. The longitudinal tracks or ways G are supported by the brackets c, and by the other brackets f^6 on the bars F, whereby these tracks or ways are adjustable laterally to vary the width of the blanks.

The two sprocket chains H are mounted on the said sprocket wheels, and arranged to travel in the tracks G, whereby the upper portions of said sprocket chains are supported for the traveling movement longitudinally of the machine.

As shown, these sprocket chains are provided with spacing blocks h, having spacing projections h' upon the upper surfaces thereof, said blocks being adjustably held on said chains by set screws h^2, whereby the distance between these blocks can be varied in accordance with the width of the stock or sheets of veneer. It will be understood that as many of these blocks can be employed as necessary, one being shown for convenience of illustration as they are all alike. These blocks can be placed and arranged in such manner that spaces of any desired size will be left between the blanks. For example, four strips of veneer can be placed in position for a blank, and then a strip can be omitted to form a space between this blank and the next one. These blocks provide shoulders h^3 upon which the sheets of veneer are supported in horizontal position. The edges of the said sheets are spaced apart by the projections h'. The endless traveling work-holder thus provided is operated by a ratchet feed mechanism, consisting of an arm I pivoted on the shaft f^3, and provided with ratchet pawls i adapted to engage the ratchet wheel i' which is fast on said shaft. The pitman i^2 is preferably connected with a block i^3 which is adjustable longitudinally of the arm I, by means of a hand screw i^4 extending from the end thereof. With this arrangement the length of the

arm I is, in effect, varied or changed to regulate the action of the feed mechanism, the pitman i^2 being actuated by an eccentric i^3 on the main drive shaft J which crosses the machine at the bottom thereof. Preferably, the guides G are provided with flanges g upon the upper edges of which the end portions of the sheets of veneer rest and slide along. And these outer end edges of the sheets of veneer are engaged by the guards g^1 secured upon the outer surfaces of the flanges g, in the manner shown more clearly in Fig. 12. Preferably, the said sprocket chains are composed of long links h^4, which are connected by intermediate or short links h^5, said long links being single and serving as a support for the spacing blocks h, each long link being grooved to engage the inner ends of the said screws h^2, and being grooved or beveled upon the outer surfaces thereof to engage correspondingly formed portions of said spacing blocks, whereby said blocks cannot be disconnected from the chains even when the said set screws are turned enough to permit the blocks to slide longitudinally of said links.

The binding wires are carried on reels K and are brought downward and around the guide rolls k and k^1, which guide rolls are mounted one above the other upon a plate k^2, which is secured by a bolt k^3 to the bracket k^4 of the stapler, it being understood that a set of guide rolls of this character is provided for each stapler. It will be seen that the wire is arranged inside of the roll k and outside of roll k^1, whereby a tension is given the binding wires, each binding [fol. 1813] wire then being guided horizontally below the stapler by the guide tube k^5, which is mounted in a suitable manner for vertical adjustment on the bracket k^4, each guide tube being cut away for a portion of its length, and each tube having a spring k^6 that bears down upon the wire at the place where the said tube is cut away. This spring is secured upon the tube by a screw k^7, and if desired, the construction may be such that the tension of the said spring can be adjusted by rotation of the said screw. The bolt k^3 is threaded at one end and provided with a nut whereby the angle of the plate k^2 may be changed at will to vary the tension of the wire, it being observed that the tension will be made greater by moving the guide roll k toward the staples, and the guide roll k^1 away from the stapler, as this will produce a more acute bend or kink in the wire, and

the drag or back pull on the wires will be consequently greater. The staples are driven cross-wise of said binding wires, and as they pass through the sheets of veneer the points of the staples are clenched by the blocks or anvils L, which are adjustably mounted upon the cross bar C, whereby the distance between these said clench blocks can be varied in accordance with the distance between the staplers.

The mechanism for feeding the staple wire consists, in each case, of a feed tube M secured to the back of the stapler, and a pair of feed rolls m, m', disposed in a position to feed the wire into the outer end of said tube, said rolls being mounted on a bracket m^2 carried by the stapler. The roll m is rigid with a ratchet wheel m^3, and this ratchet wheel is engaged by a dog or pawl m^4 carried on the end of the lever m^5, which is counted on the rock shaft m^6 which shaft is supported by suitable bearings on the frame of the machine. This dog or pawl m^4 is held in engagement with the said ratchet wheel by a spring m^7, and the rock shaft m^6 is operated by a pitman m^8 having its upper end secured to the arm m^9 on said shaft. The lower end of this pitman m^8 is actuated by a cam m^{10} mounted on the shaft J at the bottom of the machine. It will be understood that a suitable wire feed mechanism of this kind is provided for each stapler, and that the shaft m^6 carries as many feed pawls or dogs m^4 as there are staplers. The rock shaft m^{11} extends across the machine in front of the pawls m^4, said shaft being provided with notches which receive the said dogs or pawls m^4, when the latter are to actuate the feed rolls for feeding the staple wire. This shaft m^{11} has an arm m^{12} which is connected by a rod or bar m^{13} with an arm m^{14}, which has its upper end pivoted to the bottom of the stapler, and which has its lower end provided with a roll m^{15} which bears upon the stock or veneer. A spring m^{16} connects the upper end of the rod or bar m^{13} with the casting of the stapler, and tends to hold the roll m^{15} down in the position shown in dotted lines in Fig. 8. This, it will be seen, turns the shaft m^{11} enough to cause the lower corners of the notches therein to engage the dogs or pawls m^4 and force them backward and into the position shown in dotted lines in Fig. 8, thus disengaging them from the sprocket wheels of the feed mechan-

ism. It follows, therefore, that each time a gap or opening occurs in the surface of the veneer, which may be the space between the ends of adjacent blanks, the roll n^{15} moves downward, and bears upon the chain of the workholder, thus automatically causing the staple wire feed mechanism of each stapler to be tripped out of operation, whereby no staples are driven during the passage of this space below the staplers. In other words, the staple wire feed mechanism of each stapler is automatically controlled by means engaging the top of the work, and by means operated by the traveling motion of the endless traveling workholder. Thus the staple wire is saved and economized to a considerable degree. Although the staplers are continuously operated, still no staples are formed or driven between the ends of the blanks. Moreover, it will be seen that the toggle movement employed for actuating the feed rolls is of a very powerful and effective character, whereby the staple wire fed mechanism of each stapler is operated with certainty.

The mechanism for cutting the wire between the ends of adjacent blanks is as follows:

The vertically reciprocating punches N work in blocks n which are adjustable laterally on the cross bar E, each punch being disposed immediately over one of the parallel binding wires, and the lower end of each punch being received by a block or die n^1 adjustably carried on the cross-bar D. These punches are actuated at the upper ends by cam mechanism carried on the horizontal and transverse shaft n^2, which is supported in suitable bearings on the frame of the machine. This shaft is driven by a sprocket belt connection n^3, which is driven in turn by the shaft J at the bottom of the machine. The transmission from the said belt to the shaft n^2 is controlled by a clutch n^4 of any suitable known or approved character. This clutch is automatically controlled by a swinging arm n^5, which has its upper end pivoted at n^6, and which is rigid with the arm n^7, the latter being connected by a link n^8, with a catch or dog n^9, by which the said clutch is opened and closed. The lower end of this swinging arm n^5 is provided with a roll [fol. 1814] n^{10} which rests upon the upper surface of the stock or veneer, and which falls into each depression or space in the work as the blanks travel along. The construction of the said clutch is such when the roll n^{10} moves

downward in one of the spaces between the ends of two adjacent blanks, the clutch is thereby automatically closed, and the shaft n^2 is rotated to cause the operation of said punches, with the result that the binding wires are severed at a suitable distance from the rear end of the blank which has passed forward from below the said punches. As soon as the roll n^{10} strikes the forward edge of the next or following sheet of veneer, to which latter the wires have, of course, been secured, the said clutch is thereby automatically opened, with the result that the punches N are thrown out of operation, and the mechanism continues in this condition until the next opening or space occurs in the surface of the stock or veneer. It is obvious, of course, that with an endless traveling work-holder of this character the supporting surface thereof cannot always be equally divided into spaces of predetermined length for the blanks of a certain size, as at times the length of the blanks is liable to be such that an odd space will be left which is too long for a space between two blanks, and too short for a whole blank. In such case the automatic wire cutting mechanism N saves and economizes in the use of the wire, because when the blank ahead has passed the wires are cut and then, during the passing of this odd or useless space, the binding wires are not feeding forward, but to the contrary are standing still. At this time the said binding wires do not commence to feed forward again until the blank behind has moved up close enough to receive the first staples, and then immediately upon the driving of the said staples, and the consequent securing of the said wires to the said blank, the said wires begin to feed again.

As the machine is adapted to make two blanks at a time, a rotary saw O is provided at the rear end of the machine for severing the blanks along a line between the binding wires 1—2, whereby each double blank is divided into sections, each is a complete blank in itself—that is, two blanks can be made at the same time, and it is found that it is easier and more economical to manufacture two blanks at the same time this way than by making them at the same time in two separate and distinct machines. In other words, the two blanks are made by practically one and the same operation, without any additional effort or labor on

the part of the mechanics or operatives in attendance on the machine.

Also, an adjusting screw l^9 is provided in the side of the machine and arranged to engage a threaded opening in a block or some other portion which is rigid with the track, G, at this side of the machine. A gear wheel p is mounted on the said screw, which latter has its outer end supported for rotation on the frame of the machine. A pinion p^1 engages the gear wheel p and is operated by a crank p^2, whereby simple and effective mechanism is provided for easily and quickly changing or varying the distance between the two sprocket chains, and between the two guides in which the said sprocket chains travel, when it is desired to change or vary the width of the blanks.

The staplers are operated in the usual and well known manner by a vertically reciprocating cross bar Q, which latter has each end connected by a pitman q with the eccentric devices q^1 mounted on the outer ends of the shaft J. This shaft can be driven in any suitable or desired manner.

The said mechanism for automatically controlling the wire feeding device for the stapler is, it will be seen, a modification of the device shown and described in Patent No. 1,132,515, in which the control is obtained by engagement with the traveling work-holder. But with the construction herein shown and described the control of the wire feeding device is by direct engagement with the tops of the blanks, and thus the successive spaces serve through the feeding motion to control the driving of the staples.

The machine shown and described is adapted for the making of cleatless blanks, and this avoids the use of various features of construction and methods of manufacture heretofore considered necessary or desirable, as will be readily understood by those skilled in the art. Obviously, however, certain features of the invention, including the automatic controllers n^{13} and n^{7}, and their associated parts, can be employed in other environments, for various purposes, and are not necessarily limited to use in connection with a cleatless blank machine, as it is obvious that these features can be used in the manufacture of blanks of various kinds and descriptions. The invention, therefore, is not limited to the exact construction shown and de-

scribed, or any particular use, or to any particular form of box blank.

What we claim as our invention is:

1. A machine for stapling suitably prepared materials together to form blanks for the sides of boxes or crates, comprising an endless traveling workholder for the blank materials, a stapler, a staple wire feed mechanism for said stapler, and means governed by the traveling motion of said work holder for automatically tripping out the said [fol. 1815] mechanism between blanks, without interrupting the reciprocation of the said stapler, said means including a controller therefor arranged to be engaged by the materials.

2. A machine for stapling suitably prepared materials together to form blanks for the sides of boxes or crates, comprising an endless traveling workholder for the blank materials, a stapler, a staple wire feed mechanism for said stapler, and means governed by the traveling motion of said workholder for automatically tripping out the said mechanism between blanks, without interrupting the reciprocation of the said stapler, said means comprising a device that bears on top of the moving work, and means whereby the said device moves downward between blanks.

3. A machine for stapling suitably prepared materials together to form blanks for the sides of boxes or crates, comprising an endless traveling workholder for the blank materials, a stapler, a staple wire feed mechanism for said stapler, means governed by the traveling motion of said work-holder for automatically tripping out the said mechanism between blanks, without interrupting the reciprocation of the said stapler, said means comprising a roller that bears on top of the moving work, and means whereby the said roller drops down against the work-holder between blanks.

4. A machine for stapling suitably prepared materials together to form blanks for the sides of boxes or crates, comprising an endless traveling work-holder for the blank materials, a stapler, a staple wire feed mechanism for said stapler, means governed by the traveling motion of said work-holder for automatically tripping out the said mechanism between blanks, without interrupting the recipro-

cation of the said stapler, said means comprising a member pivoted to drag on the work, a rock shaft, an arm on the rock shaft, and a link connecting the said arm with the said member.

5. A machine for stapling suitably prepared materials together to form blanks for the sides of boxes or crates, comprising an endless traveling work-holder for the blank materials, a stapler, a staple wire feed mechanism for said stapler, and means governed by the traveling motion of said work holder for automatically tripping out the said mechanism between blanks, without interrupting the reciprocation of the said stapler, said means comprising a floating element resting on the moving work.

6. A machine for stapling suitably prepared materials to form blanks for the sides of boxes or crates, comprising means for moving the work along, means for wiring the blanks, and mechanism for cutting the blanks apart governed by the traveling movement of the said first-mentioned means, said mechanism having a controller therefor arranged to be engaged by the work.

7. A machine for stapling suitably prepared materials to form blanks for the sides of boxes or crates, comprising means for moving the work along, means for wiring the blanks, mechanism for cutting the blanks apart, and floating means resting on the moving work for automatically controlling said mechanism.

8. A machine for stapling suitably prepared materials to form blanks for the sides of boxes or crates, comprising means for moving the work along, means for wiring the blanks, mechanism for cutting the blanks apart, and means for engaging the moving work to automatically govern the said mechanism.

9. A machine for stapling suitably prepared materials to form blanks for the sides of boxes or crates, comprising means for moving the work along, means for wiring the blanks, mechanism for cutting the blanks apart, and means including a roller for engaging the upper surface of the moving work to automatically govern the said mechanism.

10. A machine for stapling suitably prepared materials to form blanks for the sides of boxes or crates, comprising

means for moving the work along, mechanism for cutting the blanks apart, and power-transmitting conections for operating said mechanism, having a clutch governed by the operation of said first-mentioned means, said machine having means for applying binding wires to said blanks, and said mechanism comprising a device for cutting said wires, said clutch having a controller therefore arranged to be engaged by the work.

11. A machine for stapling suitably prepared materials to form blanks for the sides of boxes or crates, comprising means for moving the work along, means for wiring the blanks, mechanism for cutting the blanks apart, and power-transmitting connections for operating said mechanism, having a clutch governed by the traveling movement of the work for automatically controlling the said mechanism.

12. A machine for stapling suitably prepared materials to form blanks for the sides of boxes or crates, comprising means for moving the work along, means for wiring the blanks, and mechanism for cutting the blanks apart, said means comprising an endless traveling work-holder, and means governed by the traveling movements of the said work-holder, and by the relative positions of the blanks thereon, for automatically controlling said mechanism.

13. A machine for applying a binding member to sheet material comprising, a stapler, means for guiding the bind- [fol. 1816] ing member below the stapler, and tension mechanism for exerting a back pull on said member at points adjacent and immediately in advance of said guiding means, said guiding means engaging the wire between said mechanism and stapler.

14. A machine for applying a binding member to sheet material, comprising a stapler, means for guiding the binding member below the stapler, and tension mechanism for exerting a back pull on said member at points adjacent and immediately in advance of said guiding means, said mechanism comprising one or more adjustable rolls, said guiding means engaging the wire between the stapler and one of said rolls.

15. A machine for applying a binding member to sheet material, comprising a stapler, means for guiding the bind-

ing member below the stapler, and tension mechanism for exerting a back pull on said member at points adjacent and immediately in advance of said guiding means, said mechanism comprising a pivoted support, and a pair of rolls mounted on said support, said guiding means engaging the wire between the stapler and one of said rolls.

16. A machine for stapling suitably prepared materials to form blanks for the sides of boxes or crates, comprising a stapler for fastening the materials together, instrumentalities for holding the materials in position, devices for causing relative movement between the stapler and materials, whereby the blanks are successively operated upon by said stapler, and mechanism having means for engaging the materials to control the operation of the stapler and thereby prevent the driving of staples between blanks, said means including a controller that rests upon the materials.

17. A machine for stapling suitably prepared materials to form blanks for the sides of boxes or crates, comprising a stapler for fastening the materials together, instrumentalities for holding the materials in position, devices for causing relative movement between the stapler and materials, whereby the blanks are successively operated upon by said stapler, and mechanism having means for engaging the materials to control the operation of the stapler and thereby prevent the driving of staples between blanks, said means including a pivoted controller that rests upon the materials, and said stapler being provided with a device for feeding wire thereto, said feeding device being governed by said controller.

18. A machine for stapling suitably prepared materials to form blanks for the sides of boxes or crates, comprising a stapler for fastening the materials together, instrumentalities for holding the materials in position, devices for causing relative movement between the stapler and materials, whereby the blanks are successively operated upon by said stapler, and mechanism having means for engaging the materials to control the operation of the stapler and thereby prevent the driving of staples between blanks, said means including a controller that rests upon the ma-

terials, said stapler and controller being in alinement with each other transversely of the machine.

19. A machine for stapling suitably prepared materials to form blanks for the sides of boxes or crates, comprising instrumentalities for successively producing the blanks in connected series, having provisions for making blanks of different lengths, and mechanism for cutting the blanks apart, said mechanism having means for engaging the blanks to properly time the operation of said mechanism.

20. A machine for stapling suitably prepared materials to form blanks for the sides of boxes or crates, comprising instrumentalities for successively producing the blanks in connected series, having provisions for making blanks of different lengths, and mechanism for cutting the blanks apart, said mechanism having means for engaging the blanks to properly time the operation of said mechanism and being provided with a clutch controlled by said means.

21. A machine for stapling suitably prepared materials to form blanks for the sides of boxes or crates, comprising instrumentalities for successively producing the blanks in connected series, having provisions for making blanks of different lengths, and mechanism for cutting the blanks apart, having means for engaging the blanks to properly time the operation of said mechanism, said means including a controller that rests upon the blanks, and said mechanism having a cutter disposed in alinement with the controller transversely of the machine.

22. A machine for stapling suitably prepared materials to form blanks for the sides of boxes or crates, comprising a stapler for fastening the materials together, instrumentalities for holding the materials in position, devices for causing relative movement between the stapler and the materials, whereby the blanks are successively operated upon by said stapler, mechanism having means for engaging the outside surface of the materials to control the operation of the stapler and thereby prevent the driving of staples between the blanks, and devices for guiding binding wire on to the surface engaged by said means, the blanks being spaced apart to provide wire ends of suitable length for each blank, and said means being directly controlled by the spaces between the blanks.

23. A machine for stapling suitably prepared materials to form blanks for the sides of boxes or crates, comprising [fol. 1817] instrumentalities for successively producing the blanks in connected series having provisions for making blanks of different lengths, and mechanism for cutting the blanks apart, having means for engaging the blanks to properly time the operation of said mechanism, devices for guiding binding wire on to the blanks, the latter being spaced apart to provide wire ends of suitable length for each blank, and said means being directly controlled by the spaces between the blanks.

24. A machine for making box or crate blanks, comprising automatic stapling and work feeding devices coöperating to fasten the blank materials together in successively spaced relation, and mechanism including an element which is movable into and out of the plane of the blanks and arranged for automatically preventing the driving of staples between blanks, controlled by the forward feeding motion of the devices which produce the feeding motion of said materials.

25. A machine for making box or crate blanks, comprising wire feeding and stapling and work feeding devices coöperating to fasten the blank materials together in successively spaced relation, and mechanism including an element which is movable into and out of the plane of the blanks and arranged for automatically preventing the driving of staples between blanks, having provisions for interrupting the wire feeding device to prevent the formation of staples without stopping the running of the stapling device.

26. A box blank machine comprising staplers, means for feeding the blank materials to the staplers in successively spaced relation, and automatically governed mechanism including an element which is movable into and out of the plane of the blanks and arranged for controlling said staplers without interrupting the running thereof to prevent the driving of staples between the blanks.

27. A box blank stapling machine having one or more staples and comprising instrumentalities to feed the materials forward, and means floating on the upper surface of said materials to rise and fall and thereby automatically control some portion of said machine, without stopping the motion

of the staplers, said instrumentalities being provided with spacing blocks held a fixed distance apart to establish spaces at predetermined intervals in the materials, and said means being rendered operative by dropping downward in said spaces.

28. In a box blank machine, the combination of devices to form spaces at intervals in the materials, mechanism to fasten the materials together, a device to feed wire to said mechanism, and means engaging the top surface of the blanks and controlled by said previously formed spaces periodically to control said device for feeding wire to said mechanism.

29. In a box blank machine, the combination of devices to form spaces at intervals in the materials, mechanism to fasten the materials together, a device for cutting wire, and means controlled by said previously formed spaces periodically to control said wire cutting device.

30. In a machine for making box blanks, feeding means for driving the material through the machine, stapling means, means to form spaces between the blanks, and means operated by the box-blank material and serving automatically to intermittently interrupt the action of the stapling means upon said material, said interrupting means having a movable controller disposed in position to rest upon the upper surface of the passing material and enter the spaces between blanks.

31. In a machine for making box-blanks, feeding means for driving the material through the machine, stapling means, means including an element supported by the blanks and operated by the box-blank material and serving automatically to intermittently interrupt the action of the stapling means upon said material, and means to form spaces in the material before the stapling thereof.

32. A machine for stapling suitably prepared materials to form blanks for the sides of boxes or crates, comprising means for moving the materials along, means for wiring the materials together to form blanks, mechanism for cutting the blanks apart, an element arranged to enter the spaces between blanks to control said mechanism, and power-transmitting connections for operating said mechanism, having a clutch governed by the operation of said

first-mentioned means, said mechanism comprising a punch and die disposed respectively above and below the work.

33. A machine for stapling suitably prepared materials to form blanks for the sides of boxes or crates, comprising means to propel the blank materials forward, means for applying a continuous binding to secure said materials together to form blanks, a clutch for governing the operation of a portion of the machine, relatively to the spaces which are necessary between blanks to provide end-portions of said binding at opposite ends of each blank, and means including an element arranged to enter the spaces between blanks to control said clutch.

34. A box blank stapling machine comprising instrumentalities to feed the materials forward, a stapler having means to apply a binding wire to the materials to form blanks, and means floating on the upper surface of said materials to rise and fall in spaces between blanks and thereby [fol. 1818] automatically control the action of said stapler.

35. A box blank stapling machine comprising instrumentalities to feed the materials forward, a stapler having a device to feed wire for the staples and coöperating with said instrumentalities to form blanks from the said materials, and means floating on the upper surface of said materials to rise and fall in spaces between blanks and thereby automatically control said device, and said device being rendered inoperative each time said means encounters a space.

36. A box blank stapling machine comprising instrumentalities to feed the materials forward, a stapler coöperating with the said instrumentalities to form blanks from the said materials, a device to cut wire, and means floating on the upper surface of said materials to rise and fall in spaces between blanks and thereby automatically control said device without stopping the motion of the stapler, and said device being rendered operative each time said means encounters a space.

37. A box blank machine comprising instrumentalities to feed the materials forward, a stapler, a wire feed mechanism therefor including a ratchet pawl, a roller floating on the upper surface of said materials to rise and fall and thereby control said pawl, a pivoted support for said roller,

a rock shaft, and a connection between said support and shaft, said rock shaft being operatively associated with the said ratchet pawl.

38. A box blank stapling machine comprising instrumentalities to feed the materials forward, a stapler, and means floating on the upper surface of said materials to rise and fall and thereby control the action of said machine without stopping the motion of the stapler, said instrumentalities including an endless traveling feed belt having spacers carried thereon to form spaces between blanks, and said means having an element which is movable into and out of said spaces.

39. In a machine for making box-blanks, stapling means, means for guiding the box-blank material through the stapling plane, with the necessary spaces formed therein, an element to engage the said material, which element is movable into and out of the plane of the traveling blanks, and means caused to operate by entrance of said element into spaces occurring at intervals in the box-blank material to intermittently interrupt the action of the stapling means upon said material.

40. In a machine for making box-blanks, stapling devices, means for guiding the box-blank material through the stapling plane, and means operated by the box-blank material to intermittently interrupt the action of the stapling devices upon said material, without interrupting the motion of said devices, said interrupting means having a movable controller disposed in position to rest upon the upper surface of the passing material.

41. A machine for making box-blanks from strips of sheet material, comprising endless link-belts, means to support said strips a distance above the tops of said belts, spacers to separate the edges of said strips, devices to actuate said belts a plurality of times for each blank, and mechanism for applying continuous binding wires to said strips between said belts.

42. A machine for making box-blanks from strips of sheet material, comprising endless link-belts, means to support said strips a distance above the tops of said belts, spacers to separate the edges of said strips, devices to ac-

tuate said belts a plurality of times for each blank, and mechanism for applying continuous binding wires to said strips between said belts, said means including blocks which are adjustable toward and away from each other on said belts to accommodate strips of different widths.

43. A machine for making box-blanks from strips of sheet material, comprising endless link-belts, means to support said strips a distance above the tops of said belts, spacers to separate the edges of said strips, devices to actuate said belts a plurality of times for each blank, mechanism for applying continuous binding wires to said strips between said belts to flexibly connect said strips together, said belts being adjustable toward and away from each other, and blocks to support said spacers on the belts, each block having a fastening device, and said belts having grooves in which said fastening devices extend to permit adjustment of the blocks toward and away from each other.

44. A machine for making box-blanks from strips of sheet material, comprising endless link-belts, means to support said strips a distance above the tops of said belts, spacers to separate the edges of said strips, devices to actuate said belts a plurality of times for each blank, and mechanism for applying continuous binding wires to said strips between said belts to flexibly connect said strips together, said belts having relatively long center links on which said spacers are mounted for adjustment toward and away from each other, and having relatively short side links to connect said long links.

45. A machine for making box-blanks from strips of sheet material, comprising endless link-belts, means to support said strips a distance above the tops of said belts, spacers to separate the edges of said strips, devices to actuate said belts a plurality of times for each blank, and mechanism for [fols. 1819-1820] applying continuous binding wires to said strips between said belts, said means including stationary guides for the ends of said strips.

46. A box-blank machine comprising instrumentalities for feeding materials and inserting fastening devices therein, and means for automatically interrupting the driving of the fastening devices, without stopping the machine, including an element which directly engages the materials and op-

erates by movement thereof into and out of the plane by the traveling blanks to govern the operation of said means, said element being operated a plurality of times for each blank.

Signed by us at St. Joseph, Berrien county, Michigan, this 1st day of March, 1912.

Edward Craig, William H. Ray.

Witnesses: T. M. Gillman, A. S. Habel.

(Here follow side folios 1821-1838.)

[fol. 1839] United States Patent Office

Edward Craig, of St. Joseph, Michigan

Wire-bound-box-blank Machine

1,258,989. Specification of Letters Patent. Patented Mar. 12, 1918

Application filed December 28, 1916. Serial No. 139,287

To all whom it may concern:

Be it known that I, Edward Craig, a citizen of the United States of America, and resident of St. Joseph, Berrien county, Michigan, have invented a certain new and useful Improvement in Wire-Bound-Box-Blank Machines, of which the following is a specification.

My invention relates to machines for making wire-bound box-blanks in general, but more particularly to the manufacture of that particular form of box-blank in which only some of the cleats of the box are secured thereto, during the manufacture of the blanks, so that the remaining cleats are not incorporated to fill the gaps in the rows of cleats on the blank until latter is folded around the end walls of the box, whereby in the manufacture of the blanks the binding wires thereof are each staples to cleats only on every other section of the blank, thus leaving the wires staples only to the veneer or other sheet-material at the places where the gaps are left in the parallel rows of cleats on the inner surface of each blank.

E. CRAIG.

WIRE BOUND BOX BLANK MACHINE.

APPLICATION FILED DEC 28, 1916.

1,258,989.

Patented Mar. 12, 1918.

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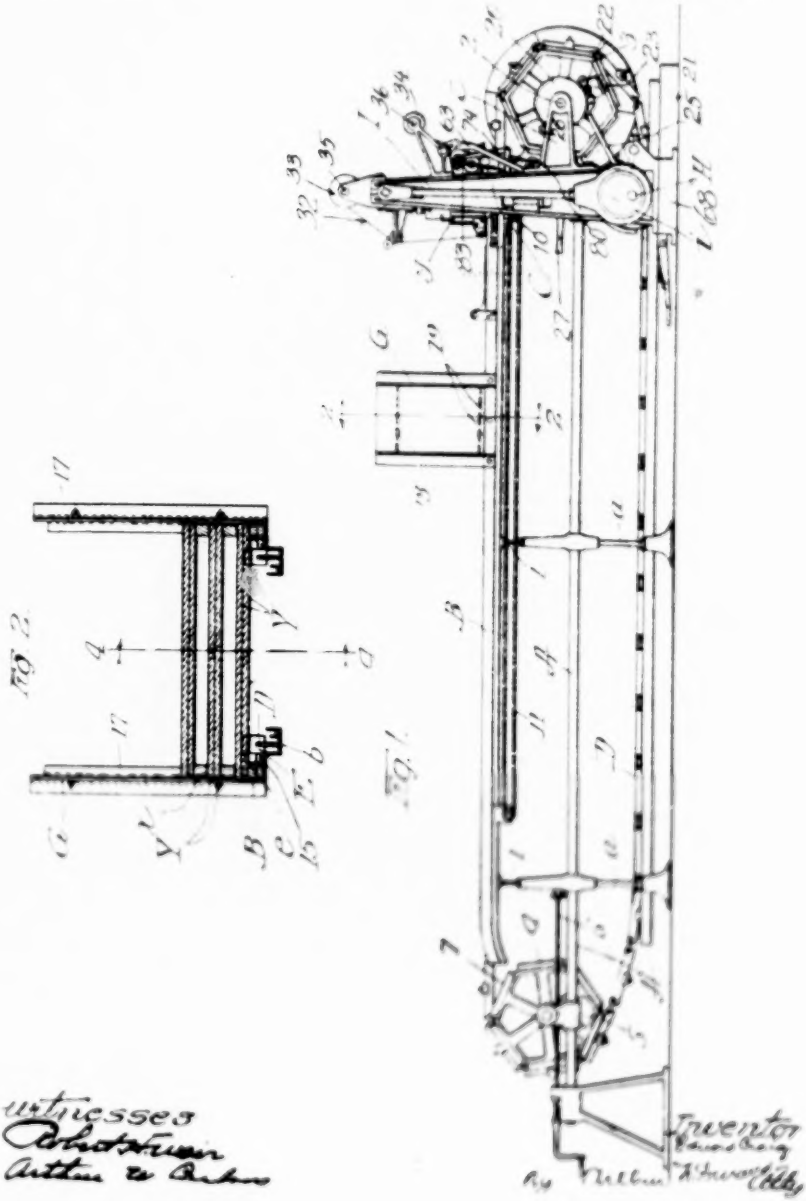

Witnesses
Robert Fraser
Arthur E. Parker

Inventor
Edward Craig
By Munn & Co
Attorneys

E. CRAIG.

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9 SHEETS—SHEET 2.

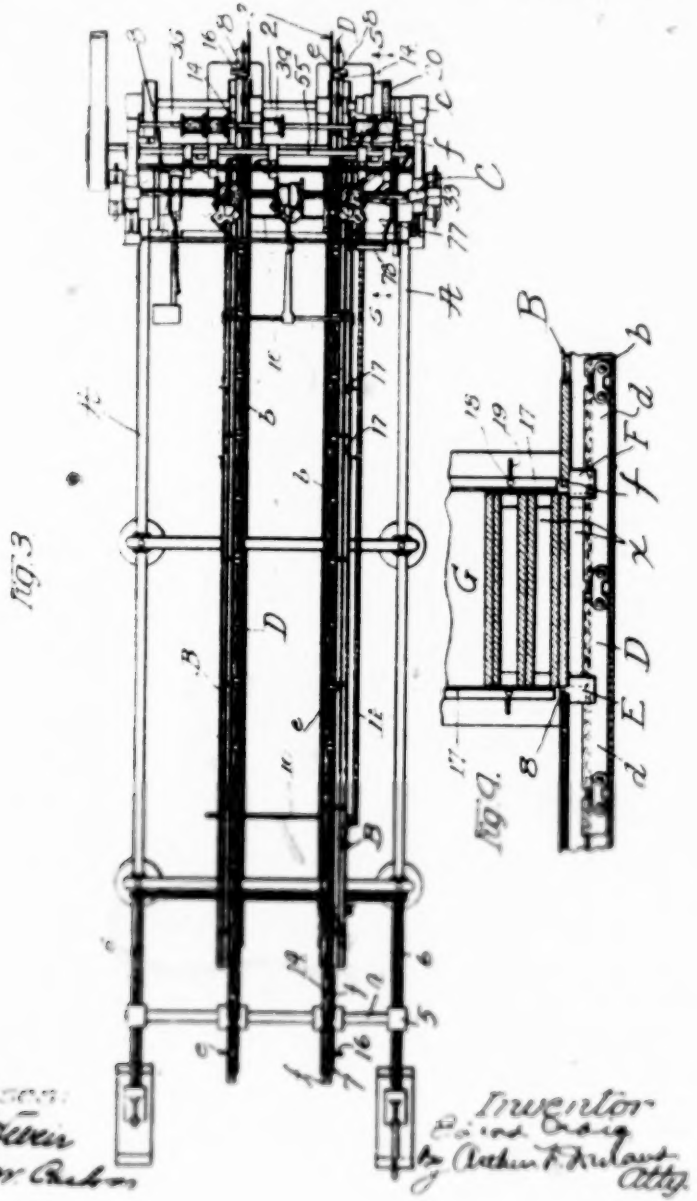

Fig. 3

Fig. 4.

Witnesses:
Robert Sawyer
Arthur W. Brown

Inventor
Edward Craig
by Arthur F. Mulard
Atty.

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Fig 5.

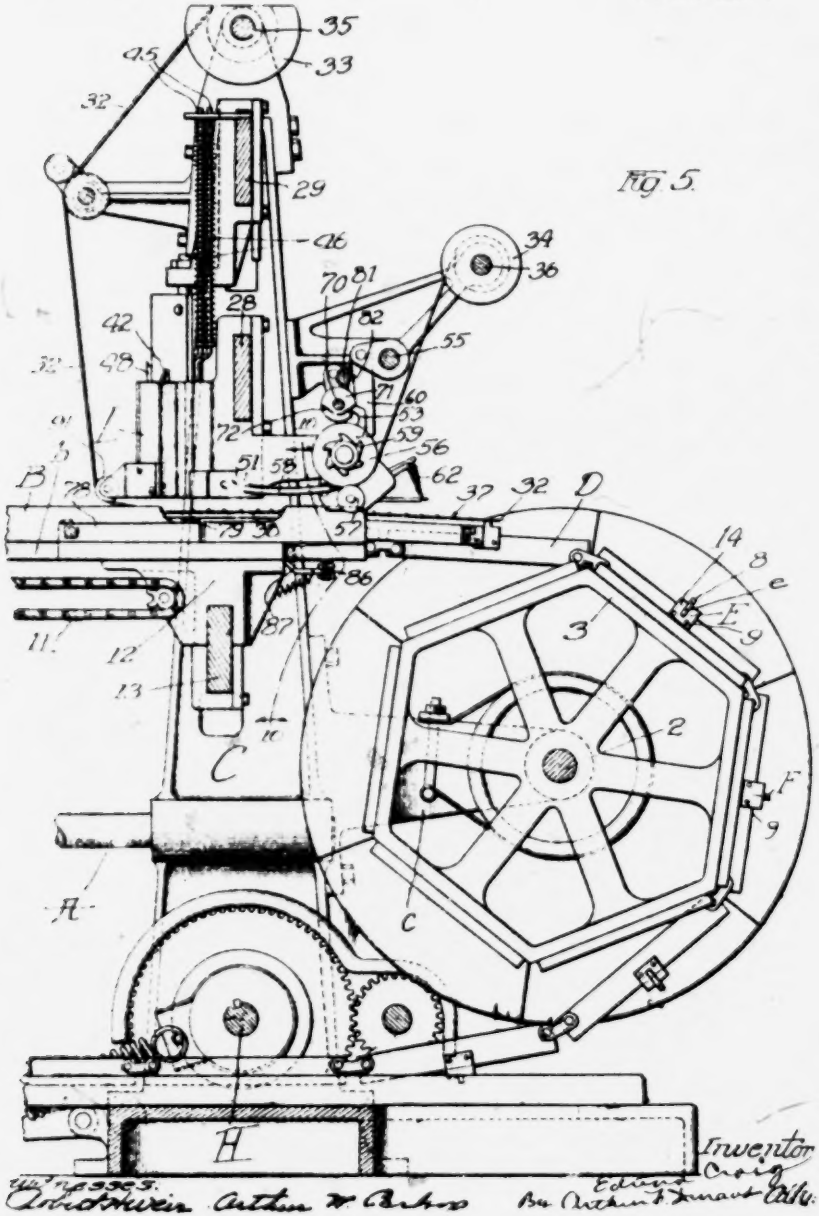

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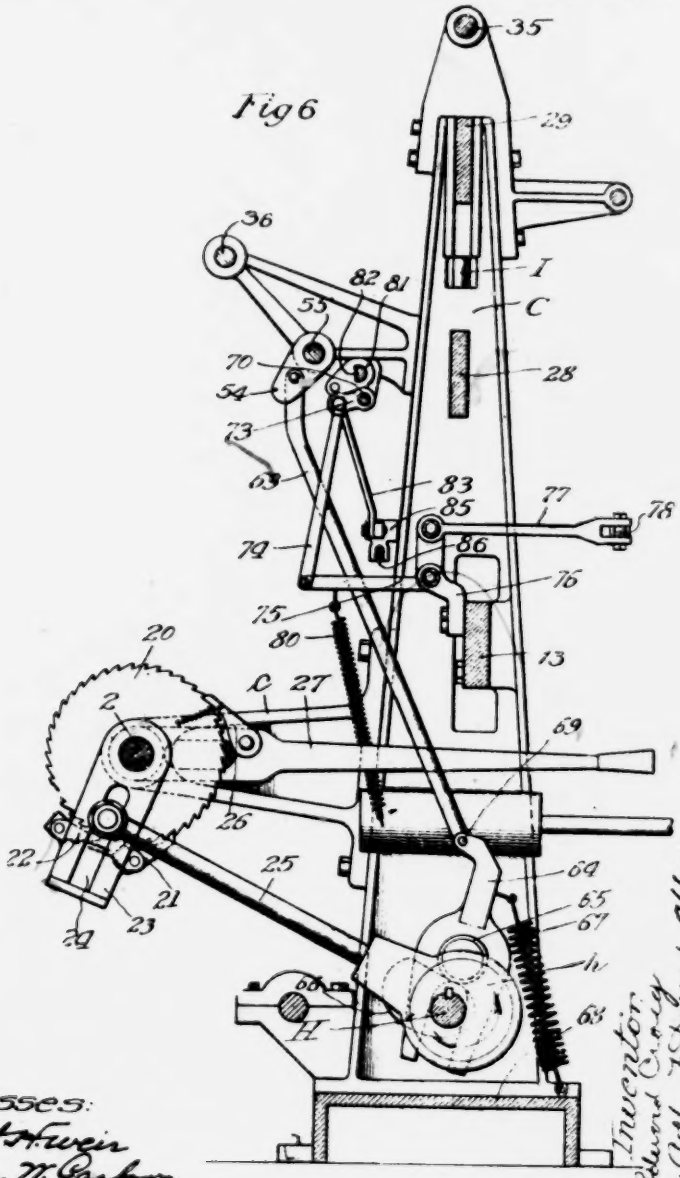
Fig 6



Witnesses:
Robert H. Fuge
Arthur M. Parker

Inventor
Edward Craig
By Arch. T. Fulwood Atty

1829-1830

E. CRAIG.

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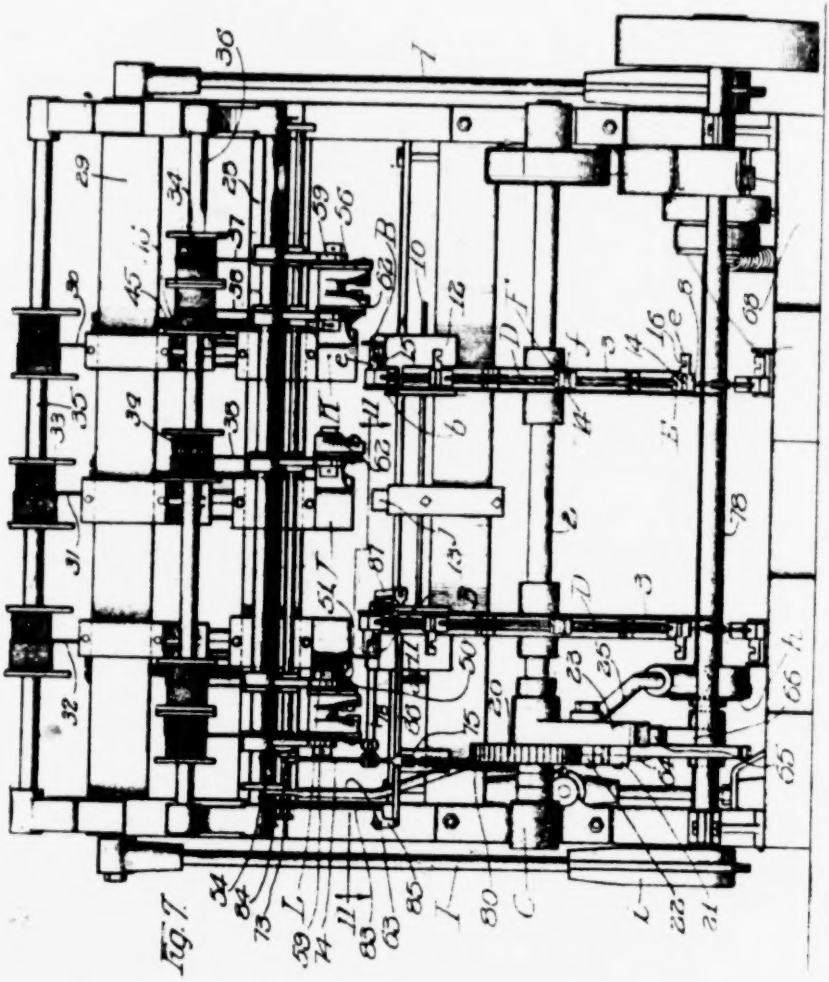

Fig 7.

Witnesses:
Robert F. Irwin
Arthur M. Cates

Inventor
Edward Craig
By Arthur L. Durant
Atty

E. CRAIG.

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Fig 9

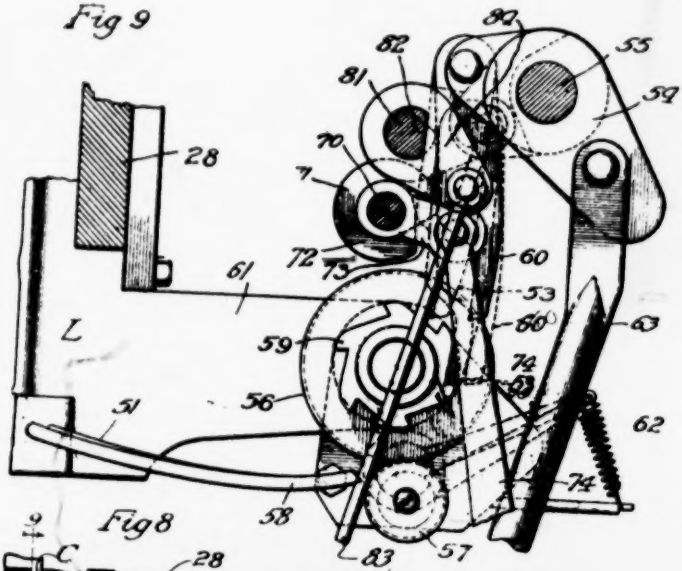
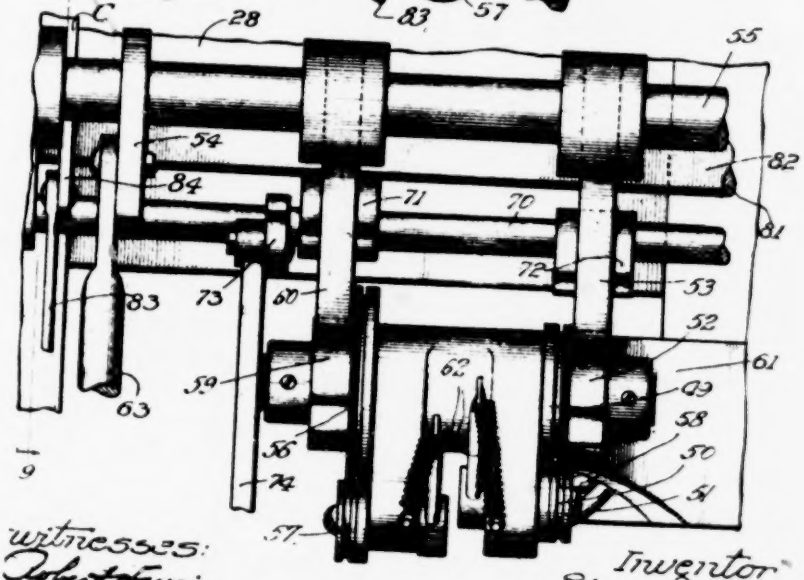


Fig 8



Witnesses:
Robert Irwin
Arthur M. Parker

Inventor
Edward Craig
By Arthur M. Durant
Atty.

1833-1834

E. CRAIG.

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9 SHEETS—SHEET 7

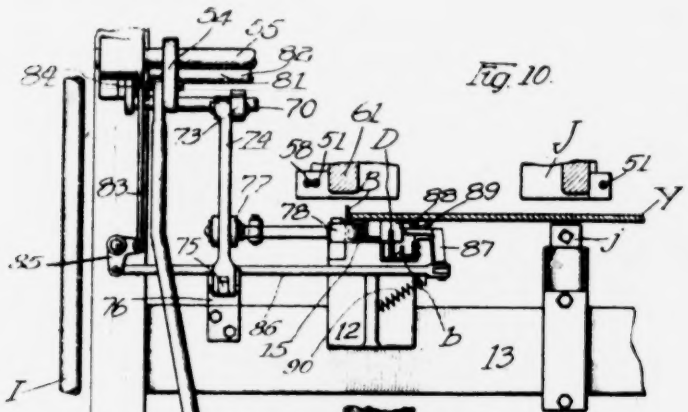

Fig. 10.

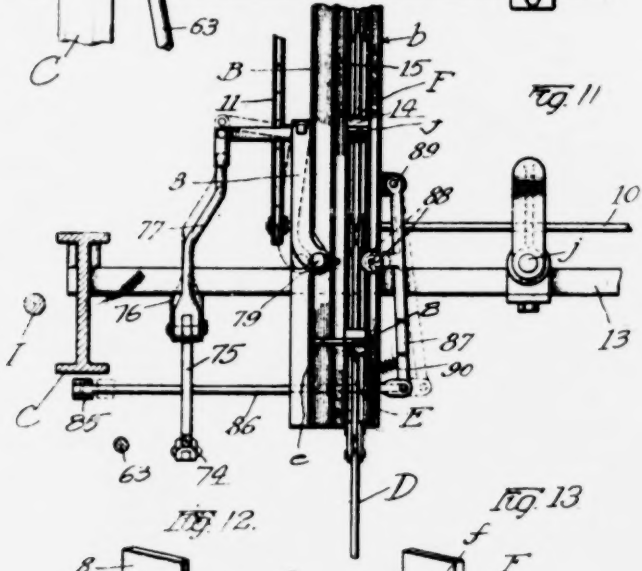

Fig. 11.

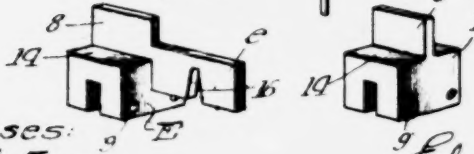

Fig. 12.

Fig. 13.

Witnesses:
Robert F. Weir
Arthur W. Barbour

Inventor
Edward Craig
By Arthur F. Dewey Atty

E. CRAIG.

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9 SHEETS—SHEET 8.

Fig. 14

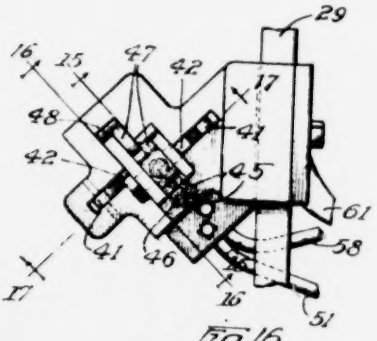


Fig. 15

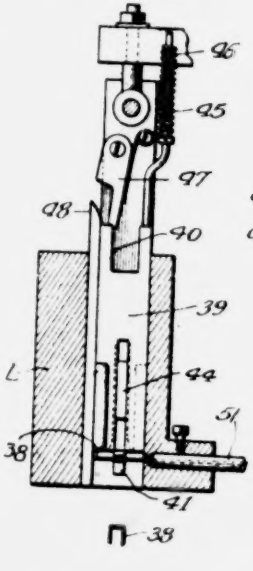


Fig. 16

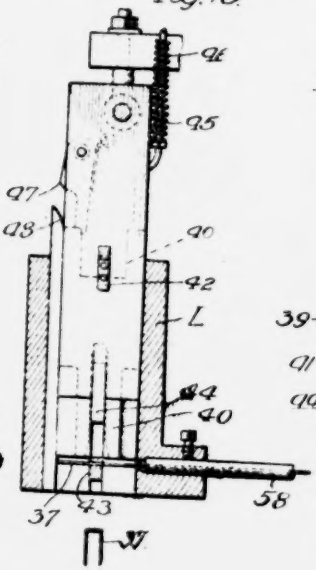
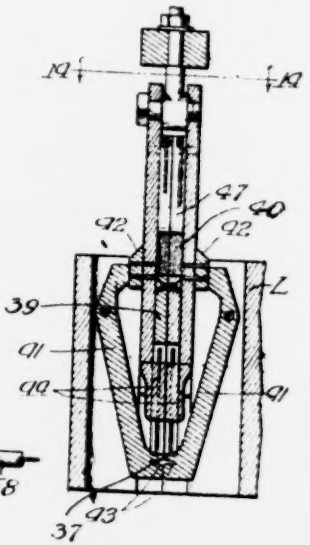


Fig. 17.



Witnesses:
Robert F. Fuller
Arthur W. Cook

Inventor
Edward Craig
By Arthur P. Donald
Atty

1837-1838

E. CRAIG.

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Fig 18.

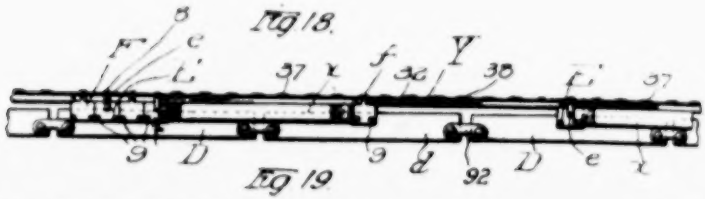


Fig 19

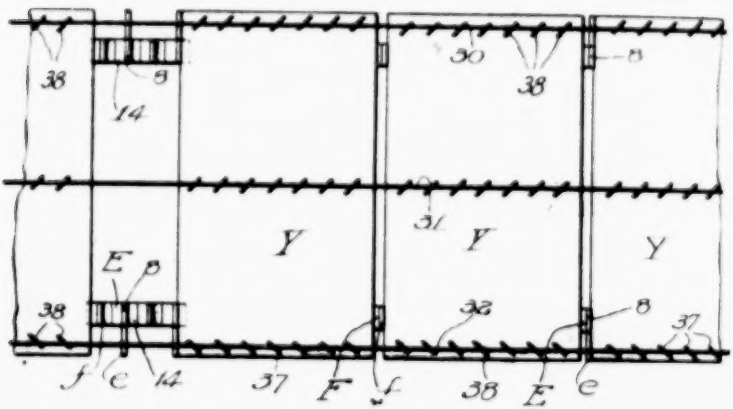
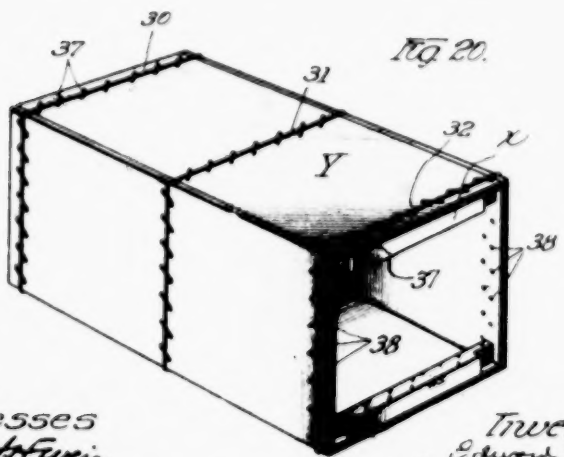


Fig 20.



Witnesses
Robert Furie
Arthur M. Carlson

Inventor
Edward Craig
By Arthur M. Durant
Atty.

Generally stated, therefore, the object of my invention is to provide a novel and improved machine for making wire-bound box-blanks.

Another object is to provide a machine for making wire-bound box-blanks of the foregoing particular character in which only some of the cleats are secured to the blanks, during the manufacture thereof, so that gaps will be left in the parallel rows of cleats of each blank.

A further object is to provide a machine of this kind having novel and improved means for preventing the driving of staples between blanks, as well as between the different sections of the same blank.

An additional object is to provide means for automatically changing the length of the staples, during the operation of making each blank, so that long staples will be driven where the cleats occur, and whereby only short staples will be driven where the cleats are omitted, thus avoiding the use of long staples where they are not needed.

A further object is to obviate the necessity of using certain devices heretofore considered necessary in the manufacture of wire-bound box-blanks.

It is also an object to provide certain details and features of construction and combinations tending to increase the general efficiency and desirability of a box-blank machine of this particular character.

To these and other useful ends, my invention consists in matters hereinafter set forth and claimed.

In the accompanying drawings:

Figure 1 is a side elevation of a wire-bound box-blank machine embodying the principles of my invention.

Fig. 2 is an enlarged cross-section on line 2—2 in Fig. 1.

Fig. 3 is a plan of the machine shown in Fig. 1.

Fig. 4 is a vertical detail section on line 4—4 in Fig. 2.

Fig. 5 is an enlarged vertical section on line 5—5 in Fig. 3, looking toward the center of the machine.

Fig. 6 is also a section on said line 5—5 in Fig. 3, but looking in the opposite direction.

Fig. 7 is a rear end elevation, on a larger scale, of said machine.

Fig. 8 is an enlarged detail view of certain parts, as shown in Fig. 7.

Fig. 9 is a vertical section on line 9—9 in Fig. 8.

Fig. 10 is a detail sectional view on line 10—10 in Fig. 5.

Fig. 11 is a plan of the devices shown in Fig. 10, being an enlarged section on line 11—11 in Fig. 7.

Fig. 12 is a perspective of one of the blocks employed on the endless link-belts for feeding the materials forward below the staplers of the machine, this form of block being used at the places which are adjacent the rear ends of the cleats of each blank.

Fig. 13 is a perspective of one of the blocks employed on said link-belts at the places which are adjacent the front ends of said cleats.

Fig. 14 is an enlarged detail sectional plan view of one of the stapler heads, being a horizontal section on line 14—14 in Fig. 17.

Fig. 15 is a vertical section on line 15—15 in Fig. 14.

Fig. 16 is a similar section on line 16—16 in Fig. 14.

Fig. 17 is a vertical section on line 17—17 in Fig. 14.

Fig. 18 is a side elevation of a portion of one of the end-[fol. 1840] less link-belts for feeding the materials, illustrating the manner in which several of the blocks shown in Fig. 13 are arranged close together wherever it is desired to establish a space between two adjacent blanks, and whereby these spaces alternate with the blanks in the continuous operation of the machine, thereby insuring projecting ends for the binding wires at the opposite ends of each blank, after the blanks are cut apart, and to permit the twisting together of the opposite ends of each binding wire after the box is completed and filled.

Fig. 19 is a plan of the link-belt structure and the blank materials shown in Fig. 18.

Fig. 20 is a perspective of one of the wire-bound box-blanks made by said machine, showing said blank folded to form a rectangular box, with the opposite ends of each wire twisted together, and with the rectangular head or end wall of the box omitted to show the construction of the blank.

As thus illustrated, my invention comprises a suitable body-frame A supported by standards *a* and having vertically adjustable screws 1 at their upper ends, the horizontally disposed and parallel guides B being supported on the tops of these screws, whereby said guides can be raised and lowered to suit the requirements. Each guide, it will

be seen, is channel-shaped in cross-section to receive and guide the cleats which are to be secured to the veneer and binding wires to form the blanks. At its rear end, the frame is provided with upright side castings C, and these castings are provided with arms *c* which provide supports for the transverse and horizontally disposed shaft 2 upon which the sprockets 3 are suitably mounted. A similar shaft 4 is supported at the front end of the frame A, by bearings 5 of any suitable character, these bearings being adjustable longitudinally of the machine by means of parallel screws 6 suitably applied thereto, and said bearings sliding on the frame A when they are thus adjusted. Endless sprocket-chains or belts D are supported by the sprockets 3, and by the sprockets 7 mounted on the shaft 4, whereby the upper stretches of these chains or link-belts travel in a substantially horizontal plane, the path of each chain being immediately inside one of the guides B, and each chain being supported by supplemental guides *b* disposed immediately inside of each cleat-guide. Blocks E are removably and adjustably secured to the link-belts at intervals, and the blocks F alternate on said chains with said blocks E, the latter being provided with fingers *e* which travel in the guides B to engage the rear ends of the cleats of the blanks. The blocks F have upstanding portions *f* to engage between the edges of the sections Y of each blank, thus forming spaces between these edges, it being understood that these sections can be made of veneer or other suitable sheet-material, and that said cleats can also be of wood. As shown in Figs. 18, 19 and 20, each box-blank comprises four rectangular sections, and the cleats X only occur on every other section, so that the blocks F do not need the fingers *e* of the other blocks. In other words, the blocks F only propel the sections having no cleats, whereas the blocks E propel both the cleats and the sections of sheet-material supported on the cleats, thus making it necessary for each block E to have not only a finger *e* to engage the rear end of the cleats, but also an upstanding portion 8 to extend between the sections of veneer or other sheet-material. As shown in Fig. 18, several of the blocks F are grouped together and mounted on each chain to form a space between adjacent blanks. Set-screws can be inserted in the holes 9 of these blocks

to adjustably hold them on the chains or link-belts, so that the distance between the blocks can be varied according to the size of blank to be made, some blanks being much longer than others, of course, in the manufacture of wire-bound boxes of different shapes and sizes. The guides B are also supported for adjustment toward and away from each other, by means of screws 10 suitably mounted on the frame and connected together by a sprocket-chain 11, whereby simultaneous rotation of these screws will shift the guides toward and away from each other. This necessitates, of course, a mounting of the sprockets 3 and 7 in such manner that they can be adjusted toward and away from each other on their respective shafts, thereby permitting the manufacture of blanks of different widths. The guides B are also, it will be understood, suitably supported on the main frame provided by the upright castings C, as by brackets 12 adjustably supported on the horizontal cross-bar 13 of said frame.

For automatically feeding the sheets and cleats to the link-belts, a hopper G is suitably mounted on the guides B, so that the sheets and cleats can be superimposed therein (see Figs. 2 and 4), to feed gradually downward and be automatically removed from the bottom of the hopper by the blocks E and F, as the latter travel along with the sprocket-chains. The cleats drop down into the guides B, in front of the fingers *e*, with a section Y upon each pair of cleats, and then a section Y without any cleats drop down in front of the blocks F, these sections of sheet-material being supported by the shoulders 14 of said blocks, in the manner [fol. 1841] shown by the drawings, and as will be readily understood. The height of the portions *f* and *s*, it will be seen, is such that they can only engage the rear edge of one sheet or section Y, thus preventing the automatic feeding forward from the bottom of the stack of more than one section at a time. As soon as one section is fully removed from the bottom of the hopper, by the forward feeding movement of the chains D, the next section then drops down behind the previous section, so that in this way four sections are automatically deposited on the feed-chains for each blank. But where the blocks F are grouped together to form a space between blanks, no section Y can drop downward until after these grouped blocks have passed, it being understood that there

is one of these groups at each side of the machine, one for each link-belt, and the two groups being arranged directly opposite each other, thereby to insure the proper space between adjacent blanks. The guides B are provided with angle-irons 15, which form the inner sides of these guides. Each finger *c* is provided with a notch 16 for the upstanding flanges of these angle-irons 15, and the latter have their upper edges disposed in the horizontal plane of the shoulders 14, so that when a section Y which has no cleats falls down at its rear edge, after the section below is nearly out from under, the said edge will rest on top of said angle-irons 15 and be held in position to be engaged by the upstanding portions *f* of the two blocks F as soon as the preceding section is entirely out from under the hopper. The inner sides of the hopper are provided with vertically disposed angle-irons 17 which are held in place by screws 18 inserted through slots 19 in the sides of the hopper. With this construction, the angle-irons 17, which are disposed in position to engage the corners of the sections of the blank, thus forming the hopper, can be moved toward and away from each other at each side of the hopper, thereby to accommodate cleats of different lengths, and different sizes of sheet-material, depending upon the size and shape desired for the box-blanks. The two sides of the hopper, being secured to the guides B, are movable toward and away from each other when the screws 10 are operated, so that the hopper will always be of the proper size to hold sheets of material for any desired width of blank.

The sprocket-chains or belts D can be operated in any suitable manner. For example, the shaft 2 may be provided with a ratchet-wheel 20, and the main drive-shaft H, disposed transversely at the bottom of the machine, and supported in bearings on the castings C', can be provided with an eccentric device *h* for operating the ratchet-dogs or pawls 21 and 22 which are pivoted on the arm 23 that swings on the end portion of said shaft. This arm has a slot 24 for adjustment of the end of the pitman 25 that connects the arm with said eccentric device, so that the feed-stroke of the ratchet-mechanism thus provided can be changed or varied at will. A detent 26 is pivoted on the hand-lever 27, to engage said ratchet-wheel 20, so that the ratchet-wheel will not rotate while the pawls 21 and 22 are

moving backward over the teeth. This hand-lever 27 is pivoted on the shaft 2 and can be used for stepping the feed-chains or belts D forward, when such is necessary or desirable. Normally, the lever 27 may rest on the main frame, so that its back stroke or motion downward is limited.

The side frames or castings C are connected together by a stationary bar 28 disposed above the sprocket-chains, and by a vertically reciprocating cross-bar 29, the latter being operated up and down on the guides of the frame by the pitmen I which have their lower ends connected by eccentric devices *i* with the shaft H, so that the bar 29 is reciprocated up and down, its motion being timed properly with respect to the intermittent feeding motion of the link-belts D by which the materials are given a step-by-step motion below said bar. As shown, the blank is provided with three parallel binding wires 30, 31 and 32, and consequently the machine must be provided with three stapling heads for driving the staples by which these wires are secured to the cleats and the sections of sheet-material. The staples for the middle wire 31 are driven by a middle stapler-head J which is mounted on the stationary bar 28, and the staple-former and driver of which are suitably connected with the reciprocating bar 29, this stapler being of any suitable or desired character and disposed in position to drive the staples cross-wise, and preferably obliquely, of said binding wire. A clench-block *j*, of any suitable character, is mounted on the bar 13 below the stapler J and in position to clench the staples on the under side of the blank. A middle reel 33 suplies the binding wire 31 to the stapler J, and a reel 34 suplies the wires to this stapler for the staples, these reels being mounted respectively on the shafts or round bars 35 and 36 disposed transversely of the machine and suitably supported at their ends by the main frame. The staplers K and L, however, which drive the staples for securing the binding wires 30 and 32 in place, are of special construction, inasmuch as these staplers are desirably, as a matter of further and special improvement, of such character that they drive long staples 37 for the sections of the blank which have cleats, and short staples 38 for the sec-[fol. 1482] tions which do not have any cleats. For example, therefore, the stapler L is constructed as shown in Figs. 14, 15, 16 and 17, being provided with a narrow staple-former 39 for making the short staples 38, and with a wider

staple-former 40 for making the staples 37, these staple-formers being of any ordinary or well-known form, and being provided with pivoted loop-bars 41, which are pivoted on the frame of the machine, and having cams 42 for the operation of these loop-bars in the usual and well-known manner. The wire for the staples is fed through the slots 43 at the lower ends of these loop-bars, directly under the staple-formers, and the staples are formed by bending the wire over the loop-bars in the usual manner, each former serving also as a wire-cutter to cut off the proper length of wire. The former 39 makes a short staple, because it cuts off a short length of wire, and the former 40, which is much wider, cuts off a longer length of wire and thus makes a longer staple. The two staple-drivers 44 slide up and down in the bifurcated ends of the staple-formers, in a manner that will be readily understood, and have their upper ends rigidly connected with the bar 29, whereas the staple-formers are yieldingly connected to said bar through the medium of rods 45 and compression springs 46, so that when the staple-formers rest upon the top surface of the blank their downward movement will cease and the staple-drivers will then move downward alone, causing the insertion of the staples in the blank. When the staple-formers start downward, to form a staple on one or the other of the two loop-bars 41, they are locked to the staple-drivers by the latches 47, which engage the upper ends of the staple-formers, and which are pivoted on the staple-drivers, but as soon as these latches strike the stationary cams 48 the staple-formers 39 and 40 are unlocked and the drivers 44 are then free to move downward alone. When the staples 38 are to be driven, wire is then fed only below the staple-former 39; but when the staples 37 are to be made, the wire is then fed only below the staple-former 40. In this way, the two staple-formers take turns at forming the staples, a number of short staples being driven in succession and then a number of long staples being driven in succession, so that only the sections of the blank which have cleats are provided with long staples, these being necessary to fasten the wires to the cleats and sheets. The sheets which do not have cleats receive the short staples, and automatic means are provided for controlling the supply of wire to the two staple-formers, so that the groups of short staples alternate with the groups of the long staples. The feed-

mechanism for feeding the wire for the staples (see Figs. 8 and 9) comprises a pair of rolls 49 and 50 which feed the wire into a tube 51, and from the latter below the staple-former 39, the roll 49 being provided with a ratchet-wheel 52 which is operated by a pawl 53 actuated by the oscillating arm 54, this arm being supported by the rock-shaft 55 which extends transversely of the machine and is suported at its ends on the main body-frame. A pair of rolls 56 and 57 feed the wire into the tube 58, and from the latter below the staple-former 40, the roll 56 being provided with a ratchet-wheel 59 operated by a pawl 60 carried on the oscillating shaft 55, so that both pawls are actuated when this shaft is rocked about its horizontal axis. The pawls 53 and 60 are, of course, pivoted at their upper ends on short arms (see Figs. 8 and 9) fixed on the shaft 55, so that when the arm 54 moves upward the pawls 53 and 60 move downward. The roll 56 is, however, somewhat larger than the roll 49, so that the feeding movement of the wire is greater in the tube 58 than it is in the tube 51, thus causing the difference in the length of the staples. Said feed-rolls are all suitably mounted on the bracket-arm 61, and the lower rolls of the two pairs are controlled by spring-tension-devices 62, of a well-known form, so that the wire is properly gripped between the rolls. The arm 54 is connected by a pitman 63 with the reciprocating member 64, which latter is provided with a roll 65 to be engaged by the cam 66 on the shaft H, a spring 67 being connected between the base 68 of the body-frame and the upper portion of said member, and a pivot 69 being provided between the lower end of said pitman and the upper end of said member. The cam 66 is of a shape and size, and is so positioned on the shaft H, that the shaft 55 is rocked at the proper time to actuate the feed-rolls and feed the wire below the staple-formers when the latter are in raised position, as will be readily understood. A shaft 70 is mounted transversely of the machine, slightly below and to one side of the shaft 55, and is provided with a pair of cams 71 and 72 for engaging the pawls 60 and 53, so that when one pawl is out of engagement with its alloted ratchet-wheel, the other pawl is in operative relation to its ratchet-wheel, thereby precluding the operation of both pairs of feed-rolls, at the same time. The shaft 70 is provided with a crank-arm 73 connected by a link 74 with a bell-crank 75, the latter being pivoted at its

elbow on its bracket 76 on the body-frame. A link 77 connects the upper end of this bell-crank-lever with the outer end portion of a bell-crank-lever 78 which is pivoted on the side of the guide B to swing in a horizontal plane. The bell-crank-lever 78 has its other end 79 shaped to enter the channel of the guide B (see Figs. 10 and 11) through a lat- [fol. 1843] eral opening in said guide, so that it is in the path of the cleats. Consequently, this bell-crank is pressed outward by the cleats, causing the shaft 70 to rock or turn in its bearings. This causes the cam 72 to throw out the pawl 53, thus rendering the feed-rolls 49 and 50 inoperative, but leaving the pawl 60 in position to operate the ratchet-wheel 59, so that wire will be fed only by the rolls 56 and 57, thus driving a series of staples 37 cross-wise of the wires and into the sheets and cleats. When the portion 79 of the bell-crank 78 again moves into the path of the cleats, when the two opposite gaps in the two rows of cleats are brought into position, the short staples 38 are then driven, for the reason that the pawl 60 is thrown out by the cam 71, leaving the pawl 53 in position to actuate the ratchet-wheel 52, whereby no wire is fed by the rolls 56 and 57 when the two pawls 53 and 60 are moved downward. Thus, the devices for feeding the wire for the staples are automatically controlled by means of a device which engages the cleats. This is not to prevent the driving of staples between blanks, or between the separate sections of a blank, but simply to change the length of the staples, so that long staples will be driven in the sections Y having the cleats X, while the short staples will be driven in the sections Y which have no cleats. A spring 80, or any other suitable means can be applied to the bell-crank-lever 78 to hold the portion 79 yieldingly in the path of the cleats.

It is also desirable, as previously stated, to prevent the driving of any staples whatever in the spaces between blanks, as well as between the sections of the same blank. This is accomplished by means of a rockshaft 81 mounted transversely of the machine immediately above the shaft 70, and supported in suitable bearings on the body-frame. This shaft has a flat side or cam-portion 82 arranged in position to bear against the pawls 53 and 60, and when this shaft is turned so that the flat side is out of engagement with the pawls, the latter are thereby disengaged from their

respective ratchet-wheels. Preferably, this is done automatically by means of a pitman 83 which is connected to the crank-arm 84 on said shaft 81, which pitman is connected to a bell-crank 85 pivoted on the main frame. This bell-crank is connected by a horizontal link 86 with the movable end of a pivot-lever 87, which latter is provided at an intermediate point with a roller 88 arranged in position to engage the side of the chain or link-belt D (see Figs. 10 and 11), whereby this lever 87 is vibrated about its axis or pivotal point 89 to rock the shaft 81 whenever any of the blocks E or F are engaged by the roller 88, thus rendering the staplers inoperative to drive any staples whatever. A spring 90 can be suitably arranged to yieldingly hold the lever 87 in position with the roller 88 in the path of the blocks E and F, against the side of the chain, so that this lever will be pushed outward by said blocks and then automatically moved back toward the chain while the latter is moving along. Thus, when the roller 88 is pushed outward and away from the chain, by the blocks E and F, the devices for feeding the wire for the staples are all rendered inoperative, and no staples are driven.

It will be understood that the stapler-head K is provided with wire-feeding devices like those of the stapler-head L, such as shown in Figs. 8 and 9, so that both of these stapler-heads are subject to control by the bell-crank lever 78 in the manner previously described. The middle head J, however, is not equipped with these devices, as it only drives one size of staple, but it is provided, it will be understood, with a wire-feeding device which is subject to control by the shaft 81, so that the operation of this stapler-head is controlled by the lever 87 to automatically prevent the driving of staples between blanks, and also between sections of the same blank, along the middle wire 31 of the blanks.

From the foregoing, it will be seen that a blank is made which is of the form and construction shown in Fig. 20, when the blank is folded, being provided with cleats on every other section Y of the blank, so that the end section which is not provided with any cleats can form the cover of the box. End walls are incorporated in the box, each end wall having a pair of cleats to fill the gaps in the rows of cleats on the blank, so that each end of the box will have four cleats forming a rectangular frame. Said cleats, it

will be understood, can be provided with tongue-and-groove formations at their ends, so that the cleats X of the blank will interlock with the similar cleats on the end walls, when the blank is folded.

It will be seen that the staples 38 are located a greater distance inward from the side edges of the blank than are the staples 37, so as to reduce the liability of splitting the veneer at the edges, and that these staples are clenched on the inner surface of the sheet-material of which the sections Y are made. This is accomplished by suitably locating the two staple-drivers 44 of the staple-heads K and L, one driver of each pair, together with its coöperating elements, being disposed a little farther toward the longitudinal center of the blank than the other. Furthermore, it will be seen that the portion 79 of the lever 78 is in the nature of a clench-block or anvil, being disposed (when in the path of [fol. 1844] the cleats) directly under the staple-former 39, and the staple-driver coöperating with the latter, so that all of the short staples are clenched on this portion 79 which swings into and out of the path of the cleats. It will be understood, of course, that a similar clench-block is mounted to operate at the other side of the machine, in conjunction with the stapler-head K, so as to clench the short staples at this side of the machine, but this other clench-block does not need to be provided with the connecting elements 73, 74, 75 and 77, for the reason that one connection of this character is sufficient to operate the shaft 70 for the purpose set forth. Thus one of the two pivoted and laterally swinging clench-blocks is suitably connected to control the feeding of the wire from which the staples are made, in the stapler-heads K and L, and in this way said clench-block or anvil has a double function, so to speak, for when it swings into the path of the cleats it not only becomes operative to clench the short staples, but also serves by this movement to stop the driving of the long staples and start the driving of the short staples.

The fingers *e* are spaced apart a distance on each link-belt substantially equal to the combined length of two cleats, so that each belt is operative to propel cleats for only every other section of the blank, which is sufficient for the purpose, inasmuch as every other cleat is omitted. As shown, the cleats at one side edge of the blank are omitted on the

same sections on which they are omitted at the other side edge of the blank. It is obvious, however, that the blocks E and F can be adjusted or re-arranged on the two link-belts in such a manner that the cleats at one side will be directly opposite the gaps in the row of cleats at the other side, whereby each section of the blank will have a cleat at one side of the blank, but will have no cleat at the other side edge of the blank. In other words, the blocks E will not be opposite each other on the two link-belts, but will be opposite the blocks F, so that the gaps in one row of cleats will alternate with the gaps in the other row of cleats, the cleats of the two rows being staggered, so to speak, and the fingers *e* of one link-belt alternating with the similar fingers on the other link-belt. In such case, obviously, the clench-block at the other side of the machine (similar to the clench-block 79) will be connected to control the wire-feed mechanism of the stapler-head K, so that long staples will be driven at one side at the same time that short staples are driven at the other side. The invention, therefore, is not limited to the production of a box-blank of the exact or particular form and construction shown and described. But in either case, as will be seen, only some of the cleats are secured to the blank, during the process of manufacture thereof, so that no endwise spacing apart of the cleats is necessary, there being no end-to-end relation of the cleats at any point on the blank. Consequently, the use of many of the devices heretofore considered necessary for spacing between adjacent ends of the cleats is entirely obviated.

Thus the device 78, it will be seen, and its clench-block 79, and the connecting elements leading to this device 78, are operatively connected to the feeding means (the ratchet feed device 20, 21, 22, etc.) through the medium of the feed belt D, and through the medium of the cleats, whereby power is communicated from said feeding means for automatically controlling the stapling mechanism, in the manner previously described. In the machine in conjunction with which my invention is illustrated, the connection between said device 78 and the feeding means is an indirect connection, so to speak, inasmuch as the device 78 does not directly engage the feed belt, but is indirectly engaged and operated by this belt through the medium of the cleats, but

in either case or in any event the devices are operatively connected with the feeding mans to automatically control the action of the stapling mechanism.

Each of the staplers J, K, L has a guide-wheel 91 disposed a distance in advance of the stapling position, to engage the binding wire, whereby all three binding wires will be guided properly below the staplers. The staplers are stationary, it will be seen, as they are mounted to occupy fixed positions during the operation of the machinery and do not move along to drive the staples. To start the machine, the binding wire must be pulled down by hand and arranged in position to receives the staples. But after the front staples are driven, so that the three wires are fastened to the first section of the blank, the feed-belts D then pull the wires along with the blank. And in this way, said belts serve to automatically feed the sheets and cleats and wires forward below the staplers.

The belts D can be of any suitable character, but preferably each belt consists of a series of single plates *d* connected end-to-end by short double links 92, and the blocks E and F are adjustable along these plates. Obviously, the devices 79 and 88 are operative to control the action of the staplers for any relative adjustment of these blocks E and F, so that cleats of different lengths can be used for the manufacture of blanks of different lengths.

I do not limit myself to the exact construction shown and described.

What I claim as my invention is:

1. A machine for making foldable box-blanks by attach- [fol. 1845] ing wires and cleats to sheet-material, comprising means to feed the cleats and sheet-material forward, with the cleats omitted at intervals on each blank, mechanism to staple the wires to the sheet-material and cleats, and devices associated with said means and periodically operated during the forward feeding movements of the sheets and cleats for automatically controlling said mechanism to drive long staples into the cleats and short staples where the cleats are omitted.

2. A machine for making foldable box-blanks by attaching wires and cleats to sheet-material, comprising intermittently operated means to feed the cleats and sheet-mate-

rial forward, with the cleats omitted at intervals on each blank, mechanism to staple the wires to the sheet-material and cleats, and devices associated with said means and periodically operated during the forward feeding movements of the sheets and cleats for automatically controlling said mechanism to drive long staples into the cleats and short staples where the cleats are omitted, said devices including an element to engage the sides of the cleats.

3. A machine for making foldable box-blanks by attaching wires and cleats to sheet-material, comprising means to feed the cleats and sheet-material forward, with the cleats omitted at intervals on each blank, stationary mechanism to staple the wires to the sheet-material and cleats, and devices associated with said means and periodically operated during the forward feeding movements of the sheets and cleats for automatically controlling said mechanism to drive long staples into the cleats and short staples where the cleats are omitted, said mechanism having one set of elements to make and drive the long staples and another set of elements to make and drive the short staples.

4. A machine for making foldable box-blanks by attaching wires and cleats to sheet-material, comprising means to feed the cleats and sheet-material fordward, with the cleats omitted at intervals on each blank, mechanism to staple the wires to the sheet-material and cleats, and devices for automatically controlling said mechanism to drive long staples into the cleats and short staples where the cleats are omitted, said mechanism being constructed to insert the short staples at points farther inward from the side edges of the blanks than the long staples.

5. A machine for making foldable box-blanks by attaching wires and cleats to sheet-material, comprising means to feed the cleats and sheet material forward, with the cleats omitted at intervals on each blank, mechanism to staple the wires to the sheet-material and cleats, and devices for automatically controlling said mechanism to drive long staples into the cleats and short staples where the cleats are omitted, said devices including means to feed different lengths of wire from which to make the staples, and said mechanism having a narrow staple-former to bend the short lengths and a wire staple-former to bend the greater lengths.

6. A machine for making foldable box-blanks by attaching wires and cleats to sheet-material, comprising means to feed the cleats and sheet-material forward, with the cleats omitted at intervals on each blank, and with a space between adjacent blanks, mechanism to staple the wires to the sheet-material and cleats, devices associated with said means and periodically operated during the forward feeding movements of the sheets and cleats for automatically controlling said mechanism to drive long staples into the cleats and short staples where the cleats are omitted, and means controlled by said forward feeding motion to prevent the driving of any staples between blanks.

7. A machine for making foldable box-blanks by attaching wires and cleats to sheet-material, comprising means to feed the cleats and sheet-material forward, with the cleats omitted at intervals on each blank, and with a space between adjacent sections of each blank, mechanism to staple the wires to the sheet-material and cleats, devices associated with said means and periodically operated during the forward feeding movements of the sheets and cleats for automatically controlling said mechanism to drive long staples into the cleats and short staples where the cleats are omitted, and means controlled by said forward feeding motion to prevent the driving of any staples between the sections of each blank.

8. A machine for making foldable box-blanks by attaching wires and cleats to sheet-material, comprising means to feed the cleats and sheet-material forward, with the cleats omitted at intervals on each blank, mechanism to staple the wires to the sheet-material and cleats, and devices for automatically controlling said mechanism to drive long staples into the cleats and short staples where the cleats are omitted, said devices including an element which is movable into the path of the cleats to clench the short staples.

9. A machine for making foldable box-blanks by attaching wires and cleats to sheet material, comprising means to feed the cleats and sheet-material forward, with the cleats omitted at intervals on each blank, mechanism to staple the wires to the sheet-material and cleats, and devices for automatically controlling said mechanism to drive long staples into the cleats and short staples where the

cleats are omitted, said devices including an element op-
[fol. 1846] erated by the cleats and provided with means to clench the short staples.

10. A machine for making foldable box-blanks by attaching wires and cleats to sheet-material, comprising guides for the cleats, endless link-belts arranged to travel parallel with said guides, means on said belts to engage and carry the sheet-material, fingers on said belts to engage the rear ends of the cleats, the fingers of each belt being spaced apart a distance substantially equal to the combined length of two cleats, so that each belt is operative to propel and position cleats for only every other section of the blank, leaving spaces where the cleats are omitted, mechanism to staple the wires to the cleats and sheet-material, means to clench the staples by clenching operations performed in said spaces, and devices to operate said belts.

11. A machine for making foldable box-blanks by attaching wires and cleats to sheet-material, comprising guides for the cleats, endless link-belts arranged to travel parallel with said guides, means on said belts to engage and carry the sheet-material, fingers on said belts to engage the rear ends of the cleats, the fingers of each belt being spaced apart a distance substantially equal to the combined length of two cleats, so that each belt is operative to propel and position cleats for only every other section of the blank, leaving spaces where the cleats are omitted, stationary mechanism to staple the wires to the cleats and sheet-material, devices to intermittently operate said belts, and means movable into and out of the path of the cleats to clench the staples where the cleats are omitted.

12. A machine for making foldable box-blanks by attaching wires and cleats to sheet-material, comprising guides for the cleats, endless link-belts arranged to travel parallel with said guides, means on said belt to engage and carry the sheet-material, fingers on said belts to engage the rear ends of the cleats, the fingers of each belt being spaced apart a distance substantially equal to the combined length of two cleats, so that each belt is operative to propel and position cleats for only every other section of the blank, leaving spaces in the guides where the cleats are omitted, mechanism to staple the wires to the cleats and sheet-ma-

terial, devices for operating said link-belts intermittently, and devices operatively connected to sai feeding mea and arranged to be operated by power comm cated the from for automatically controlling said mec usm to drive long staples in the cleats and short staples where the cleats are omitted.

13. A machine for making foldable box-blanks by attaching wires and cleats to sheet-material, comprising guides for the cleats, endless link-belts arranged to travel parallel with said guides, means on said belts to engage and carry the sheet material in a plane above the cleats, fingers on said belts to engage the rear ends of the cleats, the fingers of each belt being spaced apart a distance substantially equal to the combined length of two cleats, so that each belt is operative to propel and position cleats for only every other section of the blank, leaving spaces where the cleats are omitted, mechanism to staple the wires to the cleats and sheet-material, devices to operate said belts, an element movable into the path of the cleats, and means operated by said element to control said mechanism and cause the driving of long staples in the cleats and short staples where the cleats are omitted.

14. In a stapling machine, a movable element having means to clench the staples, and devices governed by said element to control the driving of the staples.

15. The said machine (substantially as set forth in claim 14), and means to feed material into position for stapling said element being movable into and out of the path of said material.

16. The said machine (substantially as set forth in claim 14), and means to feed material into position for stapling, said element being operated by said material during the feeding movements thereof.

17. The said machine (substantially as set forth in claim 14), said machine having mechanism controlled by said devices to alternately drive short and long staples.

18. A machine for making foldable box-blanks by attaching wires and cleats to sheet-material, comprising guides for the cleats, endless link-belts arranged to travel paral-

lel with said guides, means on said belts to engage and carry the sheet-material, fingers on said belts to engage the rear ends of the cleats, the fingers of each belt being spaced apart a distance substantially equal to the combined length of two cleats, so that each belt is operative to propel and position cleats for only every other section of the blank, leaving spaces where the cleats are omitted, mechanism, to staple the wires to the cleats and sheet-material, devices to operate said belts, and a hopper to automatically feed said cleats and sheet-material in proper order to said belts.

19. A machine for making foldable box-blanks by attaching wires and cleats to sheet-material, comprising a staple forming and driving mechanism for inserting staples to secure the wires and cleats to the sheet-material, a device to feed wire to said mechanism for the staples, and a movable element for clenching staples and connected to control the operation of said device.

20. A machine for making foldable box-blanks by attach- [fols. 1847 & 1848] ing wires and cleats to sheet-material, devices for stapling the wires and cleats to the sheets of each blank with the cleats in parallel rows and with spaces therein where some of the cleats are omitted, and means to clench the staples by stapling operations performed in said spaces.

21. In a stapling machine, a staple forming and driving mechanism, devices to feed the materials into position to receive the staples, and means controlled by said devices during the feeding movements thereof to automatically vary the length of the staples driven in each blank.

22. A machine for making box-blanks by attaching wires and cleats to sheet-material, comprising devices for stapling the wires and cleats to the sheets of each blank with the cleats in parallel rows, and with spaces therein where some of the cleats are omitted, and means including an element which is movable into and out of the path of the cleats to clench the staples in said spaces.

23. A machine for making box-blanks by attaching wires and cleats to sheet-material, comprising mechanism for driving staples to attach the wires and cleats to the sheet-material, belts having blocks thereon to position and feed

the cleats and sheets into position to receive the staples, and means including a device operated intermittently by engagement with said blocks to control the action of said mechanism.

24. A machine for making box-blanks by attaching wires and cleats to sheet-material, comprising devices for stapling the wires and cleats to the sheets of each blank with the cleats in parallel rows and with spaces therein where some of the cleats are omitted, and means to clench the staples and prevent depression of the sheet-material into said spaces by said devices during the attaching of the wires where the cleats are omitted.

25. A machine for making foldable box-blanks by attaching wires and cleats to sheet-material, comprising means to feed the cleats and sheet-material forward, with the cleats omitted, at intervals on each blank, mechanism to staple the wires to the sheet-material and cleats, and devices operatively connected to said feeding means and arranged to be operated by power communicated therefrom for automatically controlling said mechansim to drive long staples into the cleats and short staples where the cleats are omitted.

26. A machine for making wire-bound box-blanks by stapling parallel binding wires and parallel rows of cleats to sheet material, comprising stapling mechansim, means for feeding the cleats and sheets to said mechanism, with the cleats extending in parallel rows, and with gaps in said rows where some of the cleats are omitted, and means for feeding the binding wires to said mechanism so that the wires are stapled to the sheet material and cleats to flexibly connect the previously unconnected sections of the blank, and means operating where the cleats are omitted to support the sheet material against the pressure of said mechanism.

Signed by me at Chicago, Illinois, this 8th day of December, 1916.

Edward Craig.

(Here follow side folios 1849-1866.)

E. CRAIG.

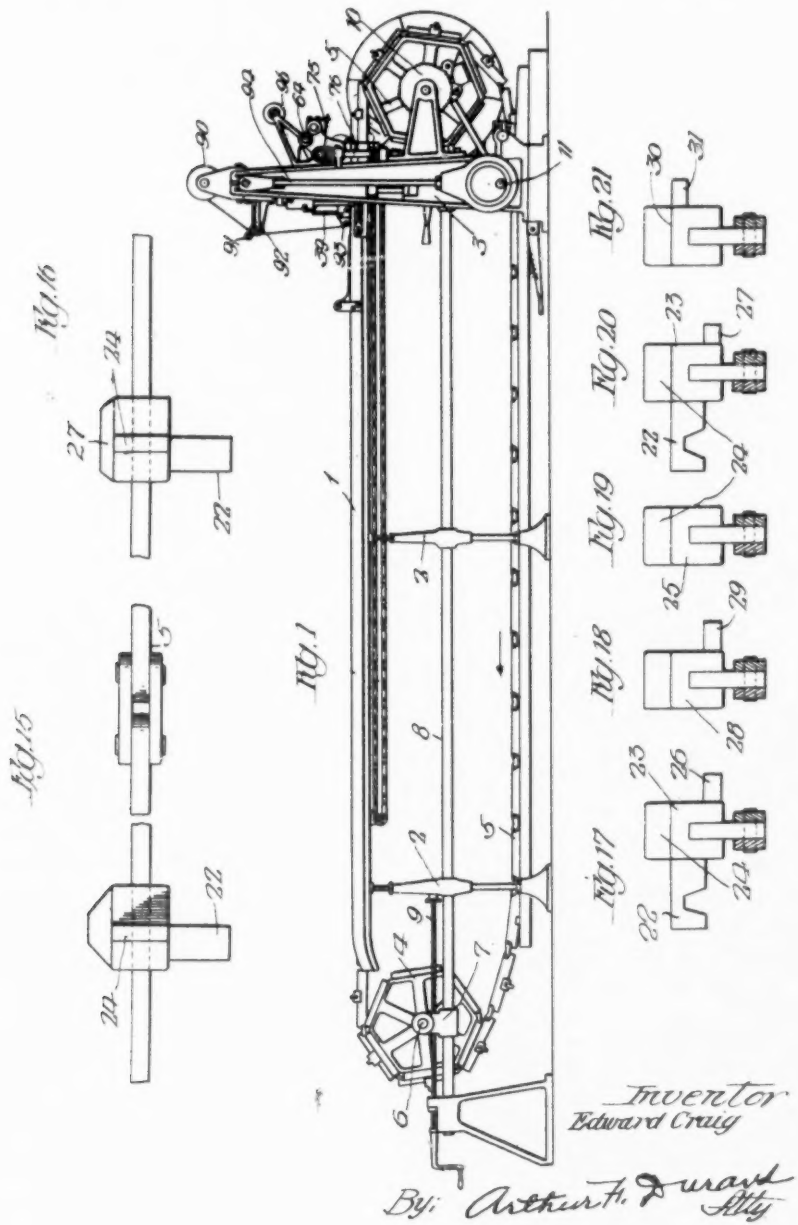
BOX BLANK MACHINE.

APPLICATION FILED SEPT. 13, 1919.

1,384,239.

Patented July 12, 1921.

9 SHEETS—SHEET 1.



Inventor
Edward Craig

By: Arthur H. Durand
Atty

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9 SHEETS—SHEET 2.

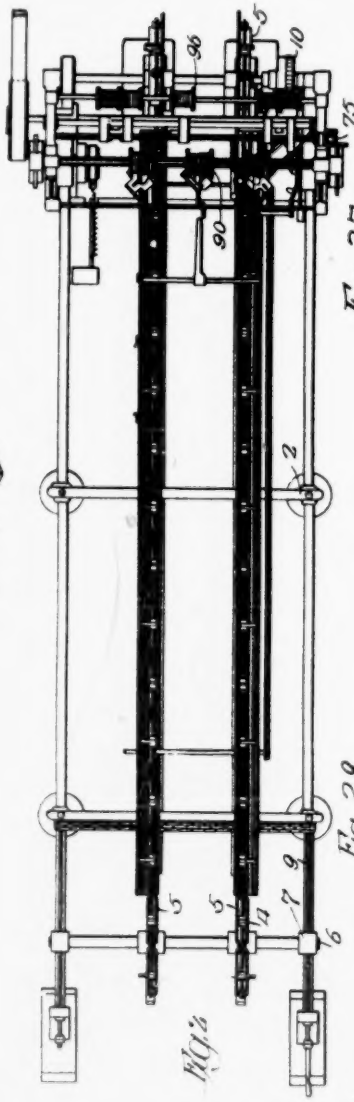

Fig. 2.

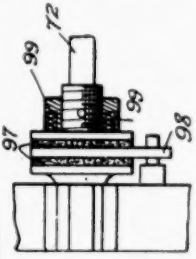

Fig. 27.

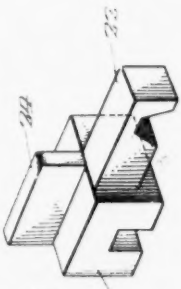

Fig. 25.

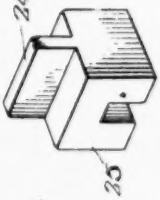

Fig. 26.

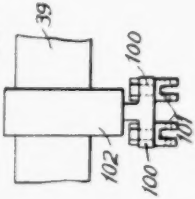

Fig. 28.

Inventor
Edward Craig

By Arthur F. Durand
Atty

1853-1854

E. CRAIG.

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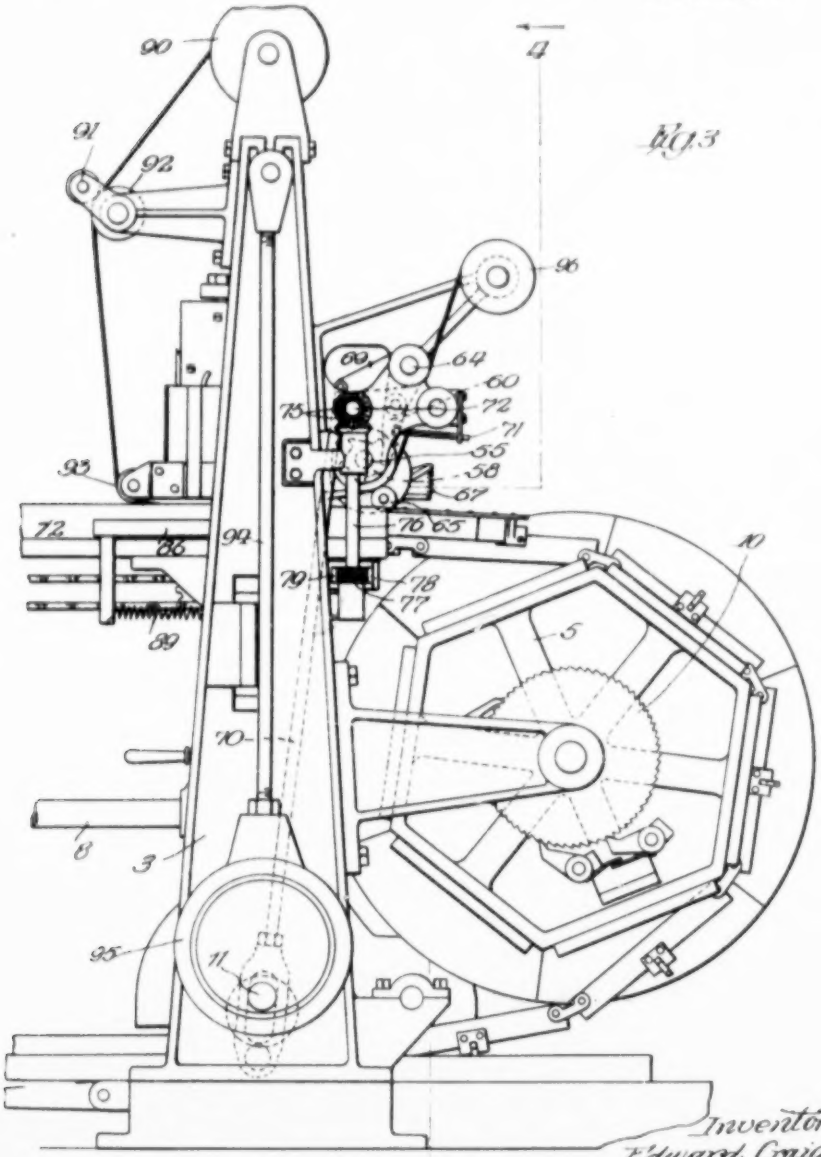
9 SHEETS—SHEET 3.



Inventor
Edward Craig
By Arthur F. Durand
Atty

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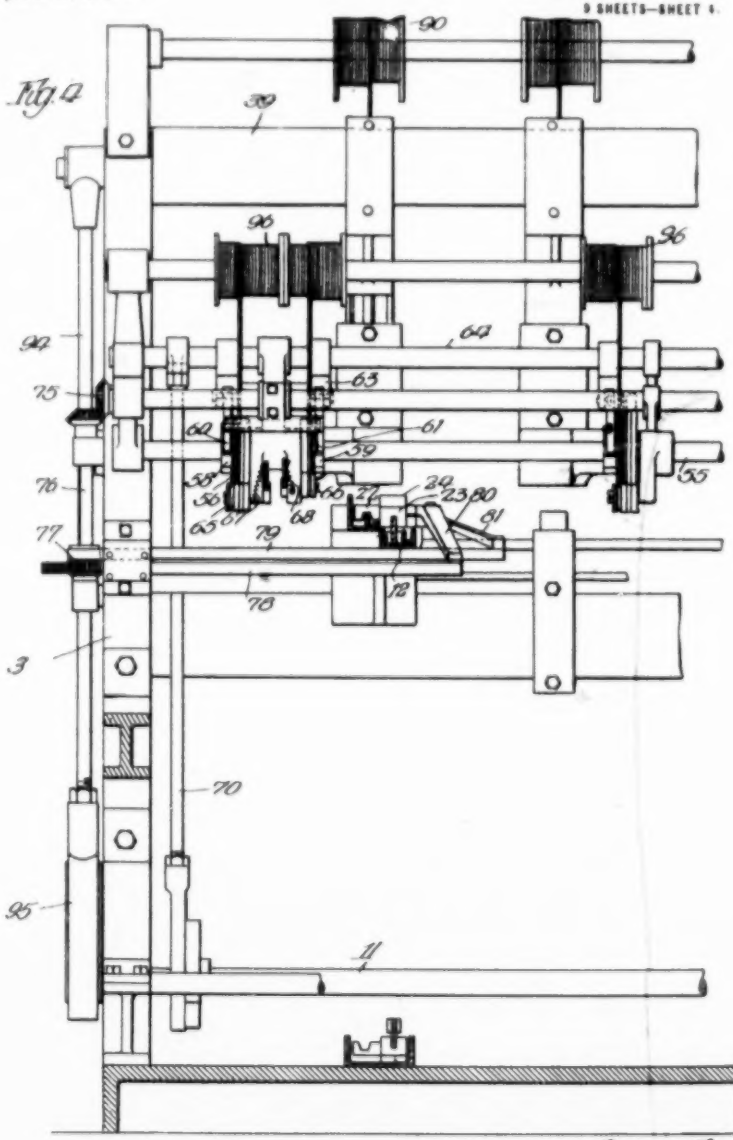
9 SHEETS—SHEET 4.

Fig. 4



Inventor
Edward Craig
By Arthur H. Durant
Atty

1857-1858

E. CRAIG.

BOX BLANK MACHINE.

APPLICATION FILED SEPT. 13, 1919.

1,384,239.

Patented July 12, 1921.

9 SHEETS—SHEET 5.

Fig. 5

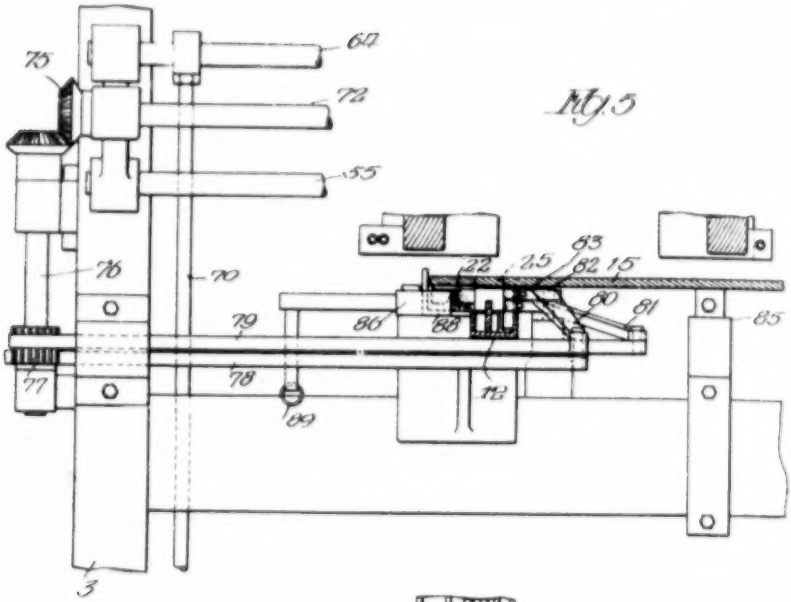
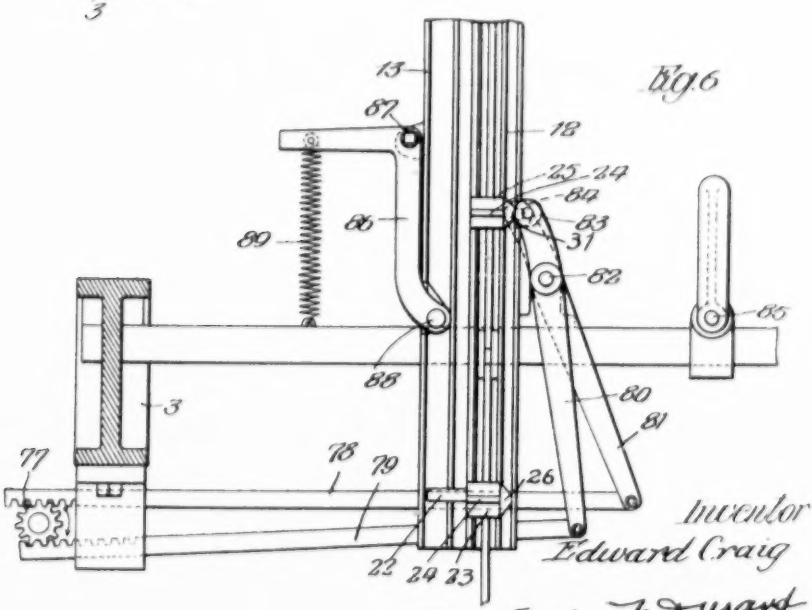


Fig. 6



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Edward Craig

By: Arthur H. Durand
Atty

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9 SHEETS—SHEET 6.

Fig 7

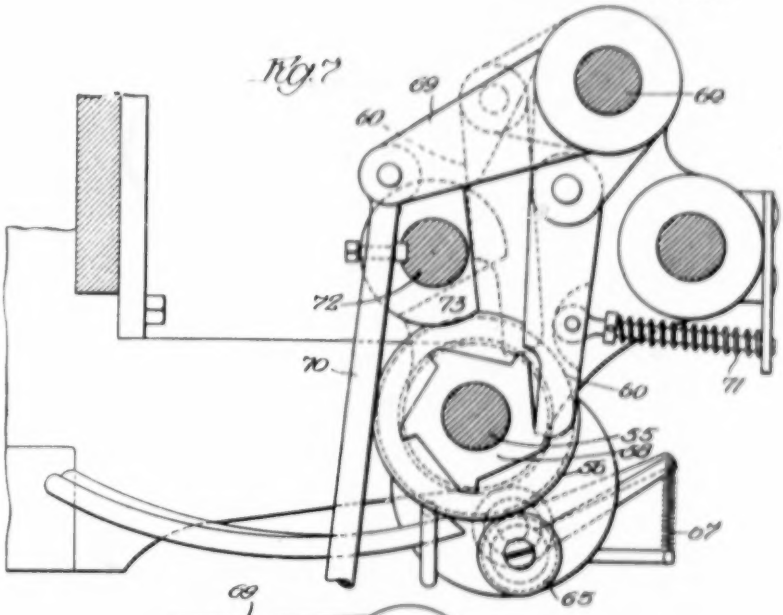
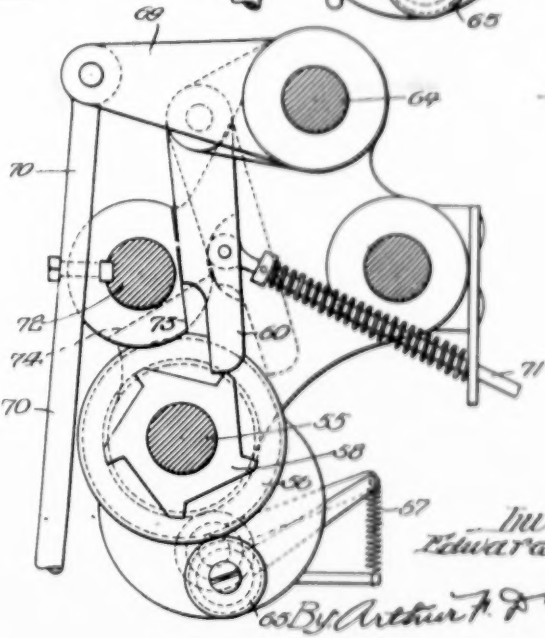


Fig 8



Inventor
Edward Craig

By Arthur F. Durant
Atty.

E. CRAIG.

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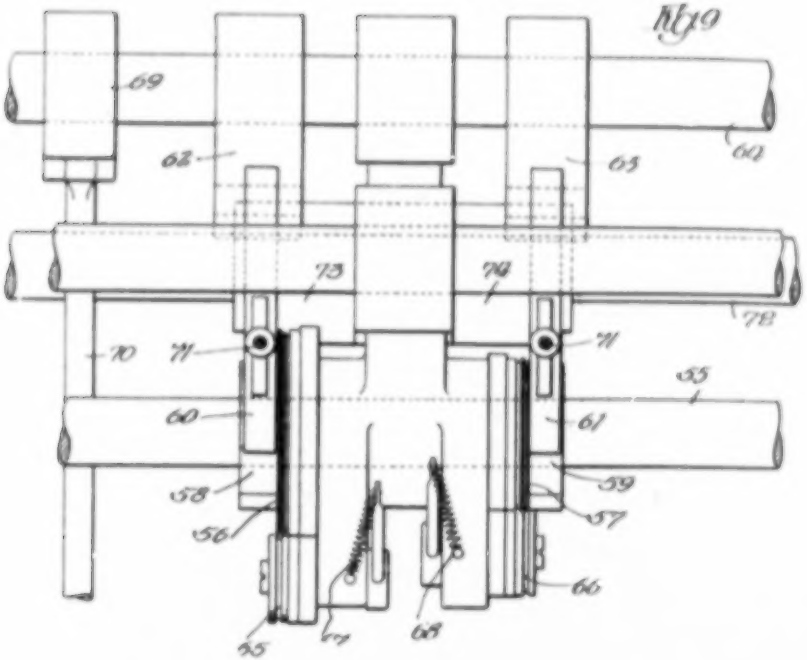
9 SHEETS—SHEET 7

Fig 9



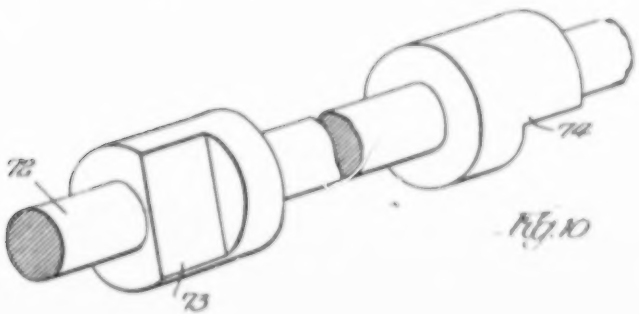


Fig 10

Inventor
Edward Craig

By Arthur A. Durand
Atty

E. CRAIG.

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9 SHEETS—SHEET 9

Fig. 11

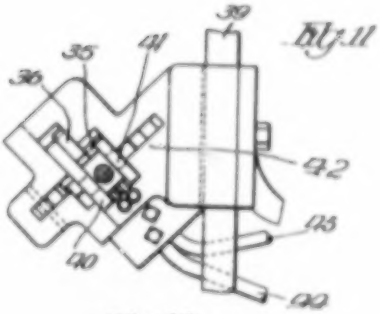


Fig. 12

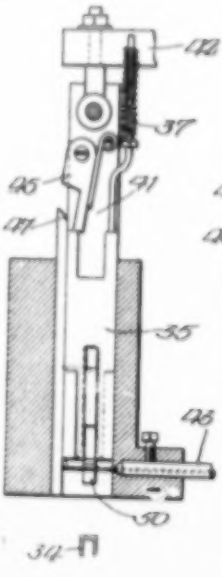


Fig. 13

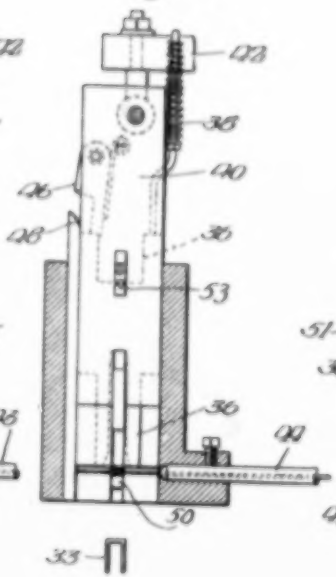
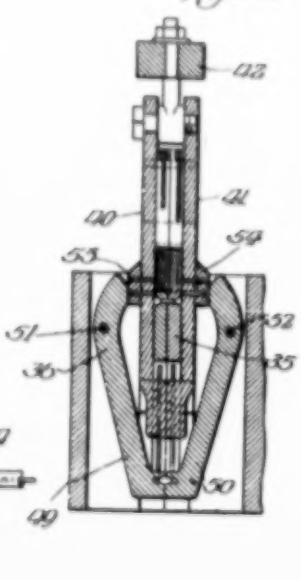


Fig. 14



Inventor
Edward Craig

By Arthur H. Durand
Atty.

1865-1866

E. CRAIG.

BOX BLANK MACHINE.

APPLICATION FILED SEPT. 13, 1919.

1,384,239.

Patented July 12, 1921.

9 SHEETS—SHEET 9.

Fig. 22

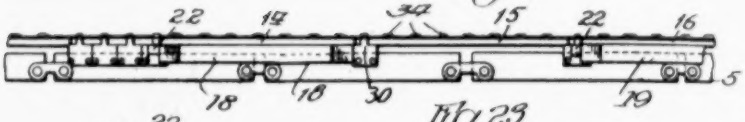


Fig. 23

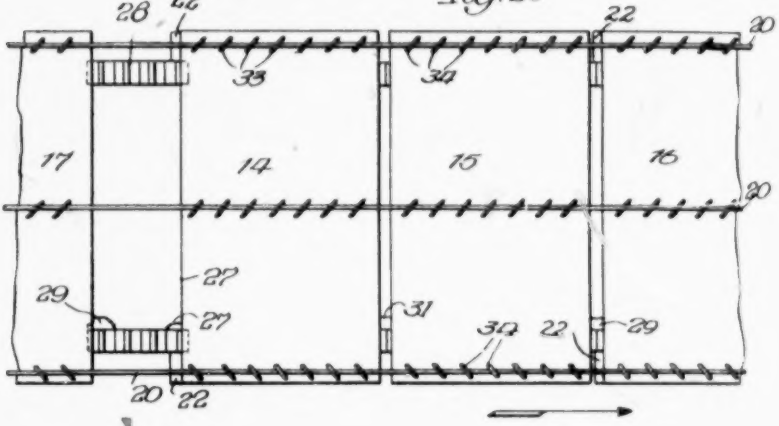
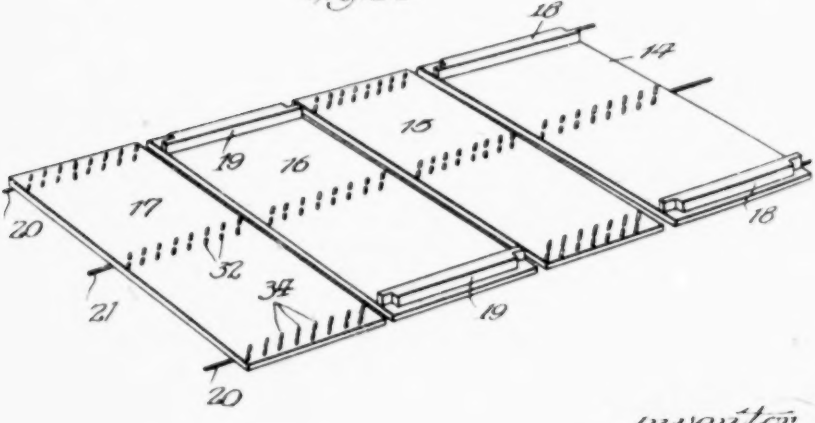


Fig. 24



Inventor
Edward Craig
By: Arthur H. Durand
Atty

[fol. 1867] United States Patent Office

Edward Craig of St. Joseph, Michigan

Box-blank Machine

1,384,239. Specification of Letters Patent. Patented July 12, 1921

Application filed September 13, 1919. Serial No. 323,494

To all whom it may concern:

Be it known that I, Edward Craig, a citizen of the United States of America, and a resident of St. Joseph, Michigan, have invented a certain new and useful Improvement in Box-Blank Machines, of which the following is a specification.

This invention relates to box-blanking machines for making wire bound box blanks, and is in the nature of an improvement on the machine shown and described in Patent #1258989, granted March 12, 1918.

One of the objects of the invention forming the present improvement is to obviate the necessity of controlling the staplers by means having direct contact with the cleats or sheets or any other portions of the blank materials, whereby such control will be exercised regardless of whether any such materials are being carried through the machine. In other words, the control exercised over the staplers for the purpose of changing from long staples to short staples, and vice-versa, or for the purpose of preventing the driving of staples between blanks, is not in any way dependent upon the materials from which the blanks are made, in the production of wire bound box-blanks of this character.

It is also an object to provide certain details and features of construction and combinations tending to increase the general efficiency and the desirability of a box-blank machine of this particular character.

To these and other useful ends the invention consists in matters hereinafter set forth and claimed, and shown in the accompanying drawings, in which—

Figure 1 is a side elevation of a box blank machine embodying the principles of the invention.

Fig. 2 is a plan of said machine.

Fig. 3 is an enlarged side elevation of the right-hand end portion of said machine.

Fig. 4 is a vertical section on line 4—4 in Fig. 3.

Fig. 5 is a detail and fragmentary view of a portion of the machine, showing certain portions in vertical section.

Fig. 6 is a plan of the parts shown in Fig. 5.

Fig. 7 is an enlarged detail sectional view showing the ratchet mechanism by which the wire is fed to the staplers.

Fig. 8 is a similar view showing said mechanism in a different position.

Fig. 9 is a rear elevation of said feed mechanism.

Fig. 10 is a perspective of the two cams which automatically control the feed mechanism and thereby control the feeding of the wire to the staplers.

Fig. 11 is an enlarged plan view of one of the stapler units, each unit, as shown and described in said prior patent, comprising one set of instrumentalities for making and driving a long staple and a second set of instrumentalities for making and driving a short staple.

Figs. 12, 13 and 14 are detail sectional views, in vertical planes, of said stapler unit.

Figs. 15 to 21 inclusive are detail views of the different blocks or devices employed on one of the endless link feed belts to not only feed the materials forward under the staplers, but also to actuate the devices which control the cams shown in Fig. 10, thereby to automatically control the feeding of the wire to the staplers.

Fig. 22 is an enlarged side elevation of said endless link feed belt, showing blank materials thereon.

Fig. 23 is a plan of the elements shown in Fig. 22.

Fig. 24 is a perspective of one of the completed box-blanks, showing the under side thereof.

Fig. 25 is a perspective of one of the feed and positioning blocks carried on one of the endless link feed belts.

Fig. 26 is a perspective of one of another kind of blocks carried on said feed-belts.

Fig. 27 shows a friction brake device for the cam shaft hereinafter described.

Fig. 28 shows a modification of the connection between the staplers and the cross-head by which they are operated.

As thus illustrated, the invention comprises a body frame composed of parallel side members 1, supported on uprights 2, of any suitable character, and the castings 3 at one

end of the machine. Sprocket wheels 4 and 5 are suitably mounted at opposite ends of the body frame, and endless [fol. 1868] link belts are supported on such sprocket wheels to travel horizontally and longitudinally of the machine. The sprocket wheels 4 are carried by a shaft 6 which is mounted in bearings 7 slidably supported on the longitudinal side bars 8, and these bearings are adjustable by means of screws 9, in the usual manner, so that the link belts can be tightened to give them the proper stretch or tension. The sprocket wheels 5 are rotated in a step by step manner by a ratchet device 10 which latter is operated in a suitable or well known manner, preferably by an eccentric connection with the main driving shaft 11 which is mounted in bearings on the upright castings 3 near the bottom of the machine. In this way, the two feed belts 5, which are spaced a suitable distance apart, are given the proper motion for feeding the blank materials forward. The two link belts 5 preferably slide in channel guides 12 which extend longitudinally of the machine, and outside of these guides channel irons 13 are arranged to extend longitudinally of the machine. The blanks to be made, as explained in said prior patent, comprise four sections 14, 15, 16 and 17 of veneer or other sheet material, with cleats 18 secured to the under surface of section 14 and similar cleats 19 secured to the under surface of the section 16, together with binding wires 20 and 21 by which the four sections of the blank are flexibly connected together in the usual and well-known manner. The cleats 18 and 19 slide in the channel guides 13, and are propelled by the fingers 22 which are carried by the feed blocks 23, the latter being adjustably secured to the chains or link belts 5 by means of set screws or any other suitable means. With this arrangement, said fingers are shaped to reach across the guides 13, and to extend downward therein a distance thereby to engage the rear ends of the cleats 18 and 19; and, in addition, the blocks 23 have upstanding portions 24 which engage the rear edges of the sheets of veneer or other sheet material to carry the latter forward. Some of the feed blocks 25 do not need the feed fingers 22, and are of the character shown in Fig. 26. Also, some of the blocks 23 have cams 26, and some of them have cams 27, as shown in Figs. 17 and 20, for a purpose that will hereinafter more fully appear. Also, there are some blocks 28 which have cams 29, and there are other

blocks 30 which have cams 31, for a purpose which will hereinafter more fully appear. As is obvious, of course, any suitable known or approved means can be employed to hold the sheets and cleats down and against rising from the guides and feed belts during the operation of the machine, and while the work is traveling forward below the staplers. With the work feeding means thus constructed, the cleats and sheets are carried forward in the manner described, as illustrated Figs. 22 and 23, preferably with the edges of the sheets of veneer slightly separated by the upstanding portions 24 with which all of the feed blocks are provided.

The stapling means and devices are as follows:

The two upright castings 3 are connected together, in the usual manner, by a stationary cross bar upon which the three stapler units are mounted. The stapler for driving the staples 32 by which the central wire 21 is secured in place may be any suitable or ordinary stapler as the staples for this purpose are all of the same length. Obviously, however, the wires 20 must be secured in place by long staples 33 that are long enough to extend through the sheet material and into the cleats 18 and 19, and by short staples 34 which are only long enough to extend through the sections 15 and 17, which have no cleats. Therefore, each stapler unit for driving the staples 33 and 34 must have one set of instrumentalities for making and forming the long staples and another set of instrumentalities for making and driving the short staples. These staple forming and driving devices are preferably of the character shown in Figs. 14 to 17, inclusive, of said prior patent, and as shown in Figs. 11 to 14 of the accompanying drawings, and will require only a brief description, as follows:

A narrow staple former (35) is provided for cutting off a short length of wire to form the short staples; and a wide staple former (36) is provided for cutting off a longer length of wire for the longer staples; and these two staple formers are connected by springs (37) and (38) to the vertically reciprocating bar (39), which forms the usual crosshead in a stapling machine of this general character, so that the staple formers are yieldably pressed down upon the work, during the insertion of the staples, in the usual and well known manner. The two staple formers are arranged flatwise together, and are disposed between the staple drivers (40) and (41), which latter are connected to

the bracket (42) which is rigidly connected to cross-bar (39), so that these staple drivers are reciprocated vertically in the well known manner. Wire for the short staples is fed through a tube (43), below the staple former (35), and wire for the long staples is fed through a tube (44) below the staple former (36). The two staple formers and drivers reciprocate up and down in unison, and whether a long staple or a short staple is made, depends upon whether the wire is fed through the tube (44) or the tube (43), as [fol. 1869] will hereinafter more fully appear. The latches (45) and (46) lock the staple formers to the staple drivers, in the usual and well known manner, and are operated by the stationary cams (47) and (48), to release the staple formers from the drivers, so that the latter will continue to slide downward after the staple formers have come to rest on the upper surface of the work. The loop bars or anvils (49) and (50) are pivoted at (51) and (52), so that their lower ends may swing into position to support the wire below the staple formers, and are operated by the cams (53) and (54) on the staple drivers. In this way, the two anvils automatically swing into position to support the wire, and then swing out of the way of the drivers as soon as the cams (53) and (54) pass downward and disengage the upper ends of said loop-bars, so that the lower ends of the latter are permitted to swing outward by gravity; thus permitting the drivers to push the staples downward and into the work.

The means for feeding the wire from which the staples are made is as follows:

The transverse shaft (55) is suitably mounted in bearings on the body frame of the machine and have the relatively large and small feed rollers (56) and (57) loosely mounted thereon and provided with ratchet wheels (58) and (59) to be engaged by their respective dogs or pawls (60) and (61), the latter being carried on cranks (62) and (63) mounted on the shaft (64) that extends transversely of the machine. Idler rolls (65) and (66) engage the feed wheels (56) and (57) respectively, these rolls being grooved, as shown, to feed the wire into the tubes (43) and (44) previously described; it will be understood that wire is fed from the rolls (57) and (66) to the tube (43), for the short staples, and between the rolls (56) and (65) to the tube (44) for the long staples. Springs (67) and

(68), employed in the ordinary or any suitable manner, serve to yieldingly press the rolls (65) and (66) against the lower side of the feed rolls (56) and (57), the roll (57) being smaller than the roll (56) in order to feed a shorter length of wire. The shaft (64) is rocked by a crank arm (69) which is actuated by a pitman (70), the latter being reciprocated up and down by a suitable eccentric or cam device on the main shaft (11) in a manner that will be readily understood. The dogs or pawls (60) and (61) are yieldingly held against the ratchet wheels by spring devices (71), in a manner that will be readily understood; and, with this arrangement the rocking motion of the shaft (64) will cause the said dogs or pawls to actuate the ratchet wheels, thereby actuating the feed rolls which feed the wire to the staplers. A rocking shaft (72) extends transversely of the machine directly in front of the said dogs or pawls, and is provided with cams (73) and (74) for engaging said dogs or pawls, so that when this shaft (72) is rocked in either direction, one pawl will be thrown out of engagement with its ratchet wheel, and the other pawl will be brought into engagement with its respective ratchet wheel; and, also, when the shaft (72) is rocked to an intermediate position, both pawls will then be out of engagement with their respective ratchet wheels. The means for rocking the shaft (72) comprises a bevel gear connection (75) with a vertical shaft (76), the latter having a pinion (77) near the lower end thereof, and being mounted in suitable bearings on the side of the body frame. Transversely arranged racks (78) and (79) engage opposite sides of the pinion (77), and are connected respectively with the upper and lower levers (80) and (81) which are pivoted at (82) on a stationary portion of the body frame. These levers (80) and (81) have rollers (83) and (84) at their shorter ends, the roller (83) being in a position to engage the cams (31) previously described, and the roller (84) being in a position to engage the cams (26), (27) and (29) previously described; and with this arrangement, when the lever (81) is actuated by one of the cams (26) or (29), the shaft (72) is then rocked into such a position that the cams (73) and (74) control the ratchet feed mechanism in such a manner that only wire for the

short staples will be fed to the two outer stapler units; and in a similar way, when the lever (80) is actuated by any cam (31) the shaft (72) is then rocked in the opposite direction and causes the cams (73) and (74) to control the ratchet feed mechanism in such a manner that only wire for the long staples will be fed to the said stapler units. When the lever (81) is actuated by one of the short cams (27) the shaft (72) is only rocked to a middle or intermediate position, leaving both of the dogs (60) and (61) out of engagement with their respective ratchet wheels, so that no wire whatever is fed to the staplers, with the result that no staples of any kind are made or driven while the space between the blanks, (as shown for example in Figs. (22) and (23)), is passing under the staplers. It will be understood that a suitable wire feeding device is provided for the ordinary stapler which drives the staples (32), and that this feeding device may be controlled in a similar manner, by the rocking of the shaft (72), thereby to prevent this feeding device from feeding any wire to the middle stapler while said space between blanks is passing under the three stapler units; it will also be understood, of course, that the center wire (21) can be omitted, if this [fol. 1870] is desired, and that in such event the middle stapler which, of course, makes and drives only short staples, will be omitted. While the shaft (72) is being rocked from one extreme position to the other, in order to change from long staples to short, or vice versa, there is an intermediate position, of course, during which both of the dogs or pawls (60) and (61) are out of engagement with their respective ratchet wheels, and in this way, and by properly gaging this period of time, no staple will be driven in the little spaces between the edges of the sections of the same box blank. In other words, the staplers will skip the spaces between the sections (14) (15) (16) and (17), and will also skip the larger spaces between blanks, these larger spaces being necessary in order to provide wire ends of suitable length for the binding wires, so that these ends can be twisted together in closing the box. In skipping a space between blanks, the cam (27), which is one of the blocks (23) at the rear edge of the blank, actuates the lever (81) to partially rock the shaft (72), with the result, as explained, that no staples are driven while the space between this blank and the next one is passing under

the staplers; but before the next blank is reached the cam (29) on one of the blocks (28) actuates this lever (81) a little farther, thus rocking the shaft (72) into the position necessary to cause the making and driving of the short staples, which latter are necessary for the oncoming first section (17) of the next blank, as this section has no cleats. Before the next section of the blank is reached, the cam (31) actuates the lever (80), thus controlling the staplers to drive the long staples in the section (16) which has no cleats on the under side thereof; and, in this way, the staplers are controlled to not only drive first short and then long staples, but also to skip the spaces between sections of the blank, and to skip the wider spaces between blanks. It will be observed that the staples (34) are driven a little farther from the side edges of the blank than are the staples (33), as explained in said prior patent.

An anvil or clench block 85 is arranged in a position to bend or clench the points of the staples 32, as the blank materials travel forward under the staples; and, for the purpose of clenching the points of the staples 34 pivoted members 86, one at each side of the machine, it will be understood, are provided and pivoted at 87 on the sides of the channel guides 13 in which the cleats 18 and 19 slide forward when the machine is in operation. These members 86 have end portions 88 that project into the guides 13, thereby to support the cleatless edge portions of the sections 15 and 17 of each blank, and to clench the short staples 34 by which the binding wires 20 are secured to these particular sections of each blank. Springs 89 are suitably applied to the members 86, thus to yieldingly hold their operative end portions 88 in the guides 13, as shown in Fig. 6; but the front ends of the oncoming cleats will bump against these inwardly curved portions 88 and push the latter outwardly from the guides, so that the cleats may pass and continue on their way below the staplers. These members 86, it will be seen, are similar to those employed for this purpose in said prior patent, but do not exercise aay control over the staplers, their sole function being to clench or bend the points of the short staples. In this way, therefore, the two levers 80 and 81 entirely control the staplers, or the action of the staplers, for the purpose of changing the staples from long to short and vice versa, and for the purpose of skipping spaces in the work as

previously explained; and this control of the operation or action of the staplers is obtained, therefore, through the medium of instrumentalities which engage the cams on the traveling work holder, whereby no contact with the cleats or other materials is necessary in order to obtain the said control thus exercised over the staplers; and with this construction and method of operation the said control of the staplers is, therefore, exercised regardless of whether any work is being carried through the machine, as without any materials whatever the step-by-step operation of the traveling work holder comprising the endless link belts would control the action of the staplers in the desired manner, so that the automatic control of the staplers is not dependent in any way upon the blank materials, notwithstanding that such control is, of course, with reference to the particular arrangement of the blank materials on the traveling work holder.

It will be understood, of course, that the different feed blocks and the cams previously described, as shown in Figs. 17 to 21 inclusive, are adjustable along the length of the link belt, so that blanks of different lengths can be made. As is common in machines of this general class, the width of the blanks can be changed by employing suitable provisions for varying the distance between the two endless link belts, and by lateral adjustment of the staplers, in the well known manner. The wire for the blanks may be conveniently carried on reels 90, in the ordinary manner, and guided by grooved rollers 91, 92 and 93 to the point where each wire bends forward to rest flatwise on the top of the blank and in this way the binding wires are guided to the [fol. 1871] points where they are stapled to the upper surface of each blank. As the blanks emerge from the machine they are separated, by cutting the binding wires between the blanks, in the usual or any suitable manner. The reciprocating crosshead 39 of the staplers can be actuated up and down in the usual manner, by pitmen 94 connected to eccentric devices 95 on the main drive shaft 11, and the different parts are so timed in their operations, of course, that the staples are driven while the box blank materials are standing still, and the work is fed forward while the staple drivers and staple formers are in their raised positions, the work coming to a standstill at about the time, or a little before, the points of the staples are just about

ready to enter the work. The wire for the staples may be conveniently carried on reels 96 suitably mounted on the machine, so that each wire will be fed to its alloted guide tube by which it is then guided below the staple former and staple driver of the stapling mechanism. It will be understood, of course, that both chains or link belts of the endless traveling work holder are equipped with the feed blocks 25, and also with the feed blocks 23, and that only the one belt which is adjacent the levers 80 and 81 is equipped with the blocks which have the cams 26, 27, 29 and 31, inasmuch as these cams are not necessary on the other side of the machine; all of the staplers being controlled by the single rock shaft 72, which extends transversely of the machine.

In Fig. 27 the shaft 72 has a pair of leather disks 97 which bear against the stationary disk 98, being yieldingly held in this relation by the springs 99, so that the rotation of the shaft 72 is retarded, thus preventing it from rotating too far at any time.

In Fig. 28 the vertically reciprocating cross-head or beam 39 is connected by vertical pivots or swivels 100 with the staple drivers of the two outside stapler units, one driver being for the insertion of the long staples and the other driver being for the insertion of the short staples, as previously described. These swivels are in the form of bolts having their lower ends provided with eyes 101 to which the staple drivers are connected, so that a vertical pivot and a horizontal pivot are provided between each driver and the casting 102 which is carried by the bar 39, which enables the two staple drivers to have a sort of self-adjusting action to allow for non-alinement or inaccuracy in the assembling of the parts, as each driver is adjustable about a vertical axis as well as a horizontal axis, as will be readily understood.

Never, however, are both swivels 100 subject to driving strain at the same time, as the two devices alternate in driving the staples, one or more staples being driven by each driver before any staples are driven by the other driver. Thus the feeding motion of the materials exercises full control over the stapling mechanism, for completely stopping the driving of staples at intervals in the work, as well as for changing the length thereof, so that

the control for both purposes is independent of the materials.

What I claim as my invention is:

1. A machine for making folding box-blanks by attaching wires and cleats to sheet material, comprising means to feed the cleats and sheet material forward, with the cleats omitted at intervals on each blank, mechanism to staple the wires to the sheet material and cleats, cams on said means, and devices associated with said means and periodically operated by said cams during the forward feeding movements of the sheets and cleats for automatically controlling said mechanism to drive long staples into the cleats and short staples where the cleats are omitted.

2. A structure as specified in claim 1, said devices comprising a pair of pivoted levers having means to engage said cams.

3. A structure as specified in claim 1, said means including blanks to engage the cleats and sheet, and said cams being carried on said blank.

4. A structure as specified in claim 1, including other cams on said means to operate said device to prevent the driving of staples between the blanks.

5. A machine for making foldable box-blanks by attaching wires and cleats to sheet material, comprising means to feed the cleats and sheet material forward, with the cleats omitted at intervals on each blank, stationary mechanism to staple the wires to the sheet material and cleats, and devices associated with said means and periodically operated during the forward feeding movements of the sheets and cleats for automatically controlling said mechanism to drive long staples into the cleats and short staples where the cleats are omitted, said mechanism having one set of elements to make and drive the long staples and another set of elements to make and drive the short staples, said devices being operable by said means regardless of whether any cleats are on the machine.

6. A structure as specified in claim 5, in combination with instrumentalities also operated by said means to prevent the driving of staples between the blanks.

7. A structure as specified in claim 5, said devices comprising a pivoted lever operated by said means to stop the driving of long staples and start the driving of short sta- [fol. 1872] ples, and another lever operated by said means to discontinue the short staples and cause the driving of the long staples.

8. A structure as specified in claim 5, all of said staple forming and driving elements being actuated regardless of whether long or short staples are being driven.

9. A machine for making foldable box-blanks by attaching wires and cleats to sheet material, comprising means to feed the cleats and sheet material forward, with the cleats omitted at intervals on each blank, mechanism to staple the wires to the sheet material and cleats, and devices for automatically controlling said mechanism to drive long staples into the cleats and short staples where the cleats are omitted, said mechanism being constructed to insert the short staples at points farther inward from the side edges of the blanks than the long staples, and means movable into the path of the cleats to clench the staples where the cleats are omitted.

10. A machine for making foldable box blanks by attaching wires and cleats to sheet material, comprising means to feed the cleats and sheet material forward, with the cleats omitted at intervals on each blank, mechanism to staple the wires to the sheet material and cleats, and devices associated with said means and periodically operated during the forward feeding movements of the sheets and cleats for automatically controlling said mechanism to drive long staples into the cleats and short staples where the cleats are omitted, and means movable into the path of the cleats to clench the staples in the spaces where the cleats are omitted from each blank.

11. A machine for making foldable box-blanks by attaching wires and cleats to sheet material, comprising means to feed the cleats and sheet material forward, with the cleats omitted at intervals on each blank, mechanism to staple the wires to the sheet material and cleats, and devices for automatically controlling said mechanism to drive long staples into the cleats and short staples where the cleats are omitted, said devices including means to feed

different lengths of wire from which to make the staples, and said mechanism having a narrow staple-former to bend the short lengths and a wide staple-former to bend the greater lengths, in combination with means movable into the path of the cleats to clench the short staples.

12. A machine for making foldable box-blanks by attaching wires and cleats to sheet material, comprising means to feed the cleats and sheet material forward, with the cleats omitted at intervals on each blank, and with a space between adjacent blanks, mechanism to staple the wires to the sheet material and cleats, devices associated with said means and periodically operated during the forward feeding movements of the sheets and cleats for automatically controlling said mechanism to drive long staples into the cleats and short staples where the cleats are omitted, and means whereby said devices are controlled by said forward feeding motion to prevent the driving of any staples between blanks, in combination with a member which is movable into the path of the cleats to clench the short staples.

13. A machine for making foldable box-blanks by attaching wires and cleats to sheet material, comprising means to feed the cleats and sheet material forward, with the cleats omitted at intervals on each blank, and with a space between adjacent blanks, mechanism to staple the wires to the sheet material and cleats, devices associated with said means and periodically operated during the forward feeding movements of the sheets and cleats for automatically controlling said mechanism to drive long staples into the cleats and short staples where the cleats are omitted, and means whereby said devices are controlled by said forward feeding motion to prevent the driving of any staples between blanks.

14. A machine for making foldable box-blanks by attaching wires and cleats to sheet material, comprising guides for the cleats, endless link-belts arranged to travel parallel with said guides, means on said belts to engage and carry the sheet material, fingers on said belts to engage the rear ends of the cleats, the fingers of each belt being spaced apart a distance substantially equal to the combined length of two cleats, so that each belt is operative to propel and position cleats for only every other section of the blank,

leaving spaces where the cleats are omitted, mechanism to staple the wires to the cleats and sheet material, means to clench the staples by clenching operations performed in said spaces, means controlled by one of said belts to automatically control said mechanism to drive long staples into the cleats and short staples where the cleats are omitted, and devices to operate said belts.

15. A machine for making foldable box-blanks by attaching wires and cleats to sheet material, comprising guides for the cleats, endless link belts arranged to travel parallel with said guides, means on said belts to engage and carry the sheet material, fingers on said belts to engage the rear ends of the cleats, the fingers of each belt being spaced apart a distance substantially equal to the combined length of two cleats, so that each belt is operative to propel and position cleats for only every other section of the blank, leaving spaces where the cleats are omitted, stationary mechanism to staple the wires to the cleats and sheet ma- [fol. 1873] terial, devices to intermittently operate said belts, instrumentalities operated by one of said belts to automatically control the operation of said mechanism, and means movable into and out of the path of the cleats to clench the staples where the cleats are omitted.

16. A structure as specified in claim 15, said instrumentalities including a plurality of pivoted levers, and the belt having cams for actuating said levers.

17. A structure as specified in claim 15, said belt having cams to operate said instrumentalities.

18. In a stapling machine, a staple forming and driving mechanism, devices to feed the materials into position to receive the staples, and means operable independently of the materials and controlled by said devices during the feeding movements thereof to automatically vary the length of the staples driven in each blank.

19. A machine for making box-blanks by attaching wires and cleats to sheet material, comprising devices for stapling the wires and cleats to the sheets of each blank with the cleats in parallel rows, and with spaces therein where some of the cleats are omitted, and means including an element which is movable into and out of the path of the

cleats to clench the staples in said spaces, in combination with means operable independently of the cleats to control said devices and thereby vary the length of the staples.

20. A machine for making box-blanks by attaching wires and cleats to sheet material, comprising mechanism for driving staples to attach the wires and cleats to the sheet material, belts having blocks thereon to position and feed the cleats and sheets into position to receive the staples, means including a device operated intermittently by engagement with said blocks to control the action of said mechanism, and means subject to said control and adapted to feed different lengths of wire to said mechanism to vary the length of the staples.

21. A machine for making box-blanks by attaching wires and cleats to sheet material, comprising devices for stapling the wires and cleats to the sheets of each blank with the cleats in parallel rows and with spaces therein where some of the cleats are omitted, and means to clench the staples and prevent depression of the sheet material into said spaces by said devices during the attaching of the wires where the cleats are omitted, in combination with means to automatically vary the length of the staples to insure shorter staples for the sheet material where the cleats are omitted.

22. A machine for making foldable box-blanks by attaching wires and cleats to sheet material, comprising means to feed the cleats and sheet material forward, with the cleats omitted at intervals on each blank, mechanism to staple the wires to the sheet material and cleats, and devices operatively connected to said feeding means and arranged to be operated by power communicated therefrom for automatically controlling said mechanism to drive long staples into the cleats and short staples where the cleats are omitted, in combination with means to clench the staples in the spaces where the cleats are omitted.

23. A machine for making wire-bound box-blanks by stapling parallel binding wires and parallel rows of cleats to sheet material, comprising stapling mechanism, means for feeding the cleats and sheets to said mechanism, with the cleats extending in parallel rows, and with gaps in said rows where some of the cleats are omitted, and means for

feeding the binding wires to said mechanism, so that the wires are stapled to the sheet material and cleats to flexibly connect the previously unconnected sections of the blank, and means operating where the cleats are omitted to support the sheet material against the pressure of said mechanism, in combination with means to automatically vary the length of the staples to insure shorter staples for the sheet material where the cleats are omitted.

24. A structure as specified in claim 18, said means comprising a friction device to prevent too much actuation thereof by said devices for either the long or the short staples.

25. In a stapling machine, the combination of a reciprocating member, a pair of staple drivers to be actuated by said member, a swivel connection between each driver and said member, providing a longitudinal axis of adjustment for said driver, and means whereby said drivers alternate in driving the staples, so that one or more staples are driven by each driver before any staples are driven by the other driver, and whereby the two swivels are never subjected to driving strain at the same time.

26. In a stapling machine for work requiring the driving of long and short staples to secure the materials together, the combination of stapling mechanism for driving first one or more staples of one length and then one or more of the other length, so that the long and short staples alternate in the work, and controlling means operative independently of said materials to control said alternate action of said mechanism.

27. A structure as specified in claim 26, in combination with means serving at intervals to prevent said mechanism from driving any staples of either length.

28. A structure as specified in claim 26, in combination [fol. 1874] with means also independent of said materials to prevent at internals the driving of any staples of either length.

29. A structure as specified in claim 26, said controlling means including an intermittently movable means to feed the materials under said mechanism.

30. A structure as specified in claim 26, said controlling means comprising a link belt to feed the materials under said mechanism, in combination with means whereby the feeding motion serves at intervals to prevent said mechanism from driving any staples of either length.

Edward Craig.

(Here follow side folios 1875-1898.)

[fol. 1899] Patented Sept. 29, 1925. 1,555,189

United States Patent Office

Edward Craig, of St. Joseph, Michigan, Assignor to Saranac Automatic Machine Corporation, of Benton Harbor, Michigan, a Corporation of Delaware.

Method and Apparatus for Making Wirebound Boxes

Application Filed April 2, 1923. Serial No. 629,341

To all whom it may concern:

Be it known that I, Edward Craig, a citizen of the United States, and resident of St. Joseph, Berrien County, Michigan, have invented a certain new and useful Improvement in Methods and Apparatus for Making Wirebound Boxes, of which the following is a specification.

This invention relates to the manufacture of wire bound boxes of that kind in which each wire bound box blank comprises a plurality of sections, either cleated or uncleated, bound together by parallel wires or by other metal binding, so that the ultimate boxes to be produced from these blanks will each have a top and bottom and two side walls, and either open or closed ends, depending upon the type of blank employed. A cleatless blank, of course, requires end walls in order to give it stability, for the cleatless blank is not in itself a box, and is not so recognized. On the other hand, a full cleated blank, namely one having four sections and eight cleats thereon, is in one sense a complete box in itself, inasmuch as such a blank can be used without heads or end walls, in a manner that is very com-

DEFENDANT'S EXHIBIT NO. 20.

1876

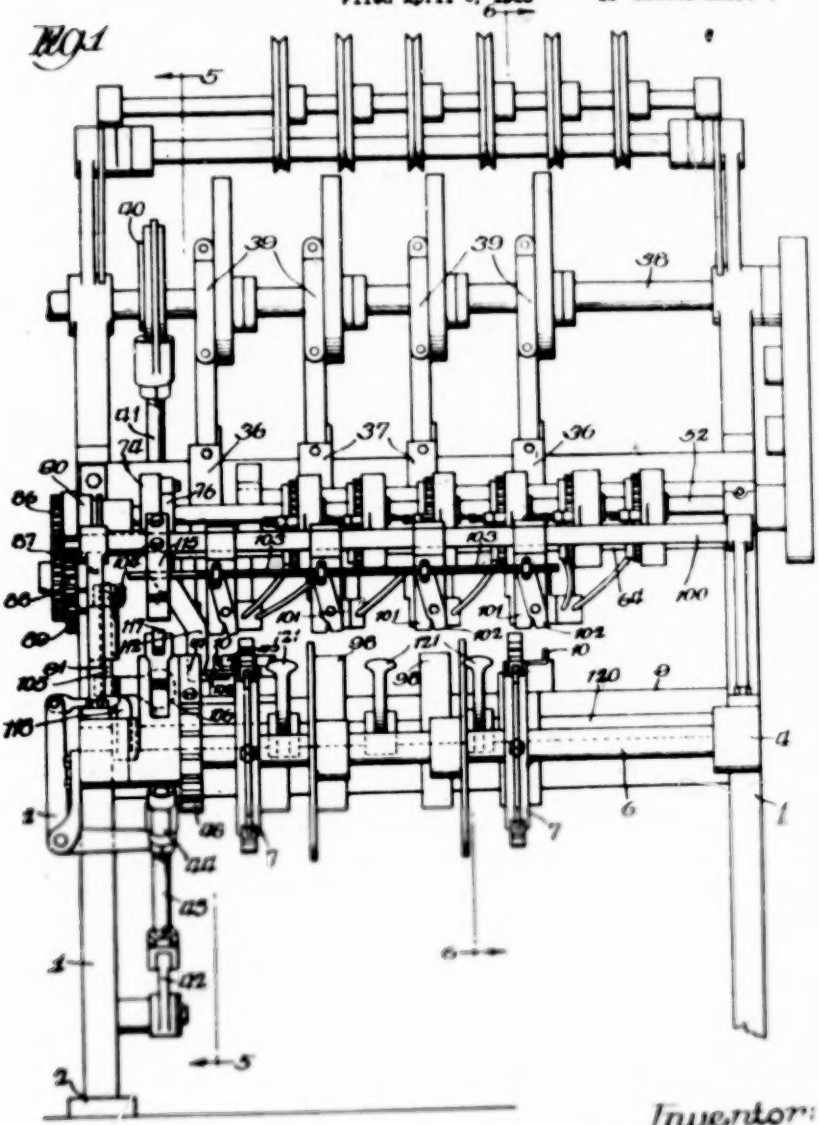
Sept. 22, 1925. 1,555,189

E. CRAIG

METHOD AND APPARATUS FOR MAKING WIREBOUND BOXES

Filed April 2, 1923 12 Sheets-Sheet 1

Fig. 1



Inventor:
Edward Craig
By Arthur H. Durand Atty

Sept. 29, 1925. 1,555,189

E. CRAIG

METHOD AND APPARATUS FOR MAKING WIREBOUND BOXES

Filed April 2, 1923 12 Sheets-Sheet 2

Fig. 2

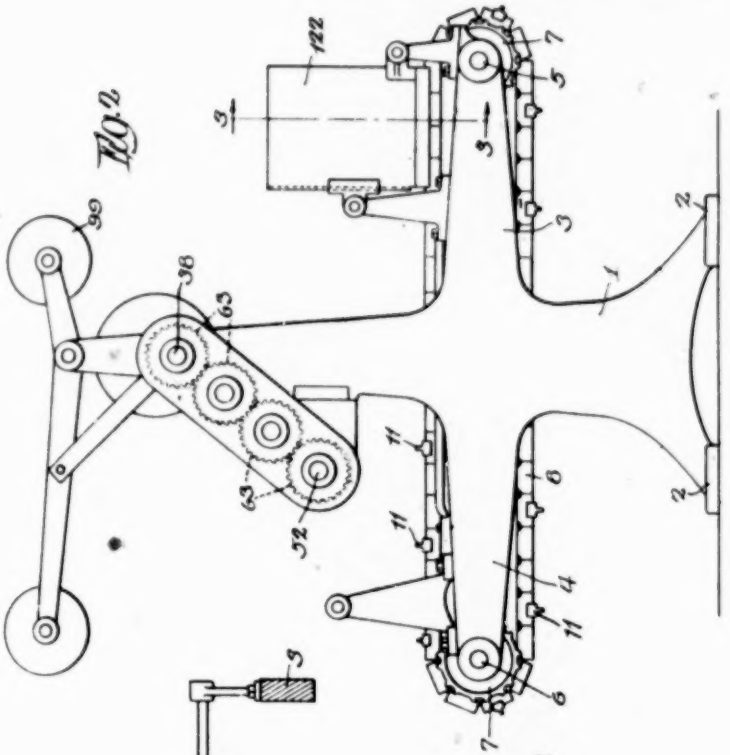
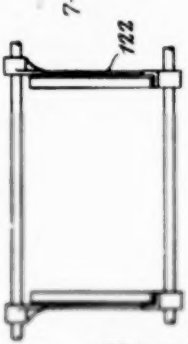


Fig. 3

Fig. 4



Inventor
Edward Craig
by Arthur F. Durant Atty.

1879-1880

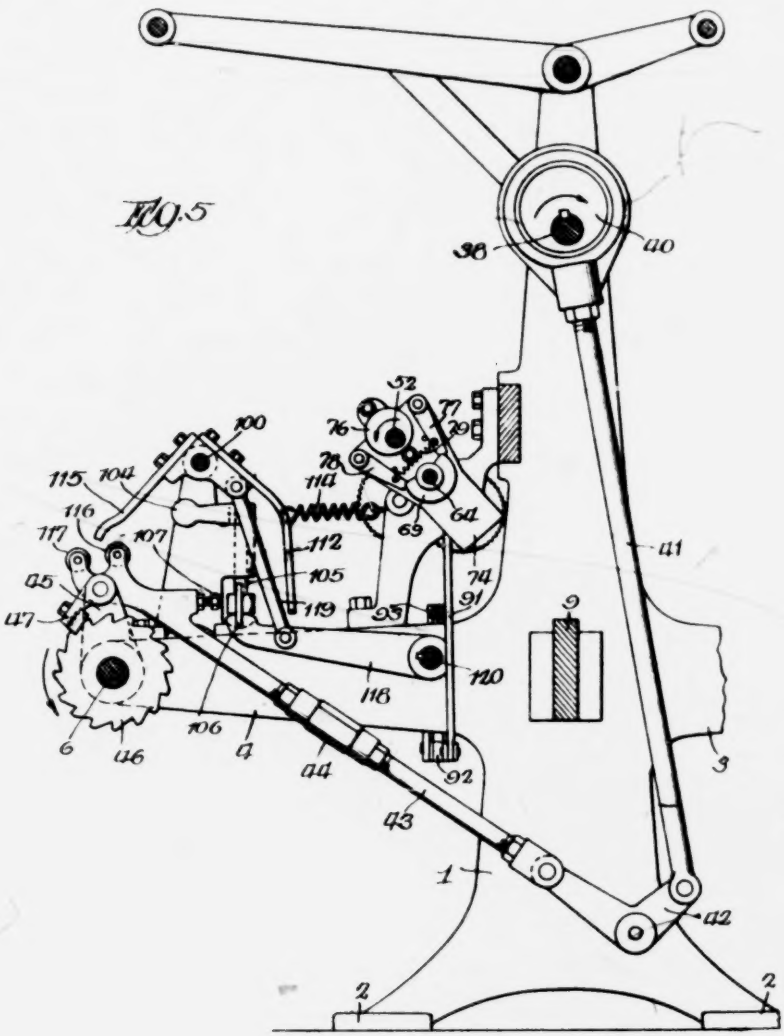
Sept. 29, 1925. 1,555,189

E. CRAIG

METHOD AND APPARATUS FOR MAKING WIREBOUND BOXES

Filed April 2, 1923 12 Sheets-Sheet 3

FIG. 5



Inventor:
Edward Craig
by Arthur H. Durand Atty.

1881-16

Sept. 29, 1925.

E. CRAIG

1,555,189

METHOD AND APPARATUS FOR MAKING WIREBOUND BOXES

Filed April 2, 1923 12 Sheets-Sheet 4

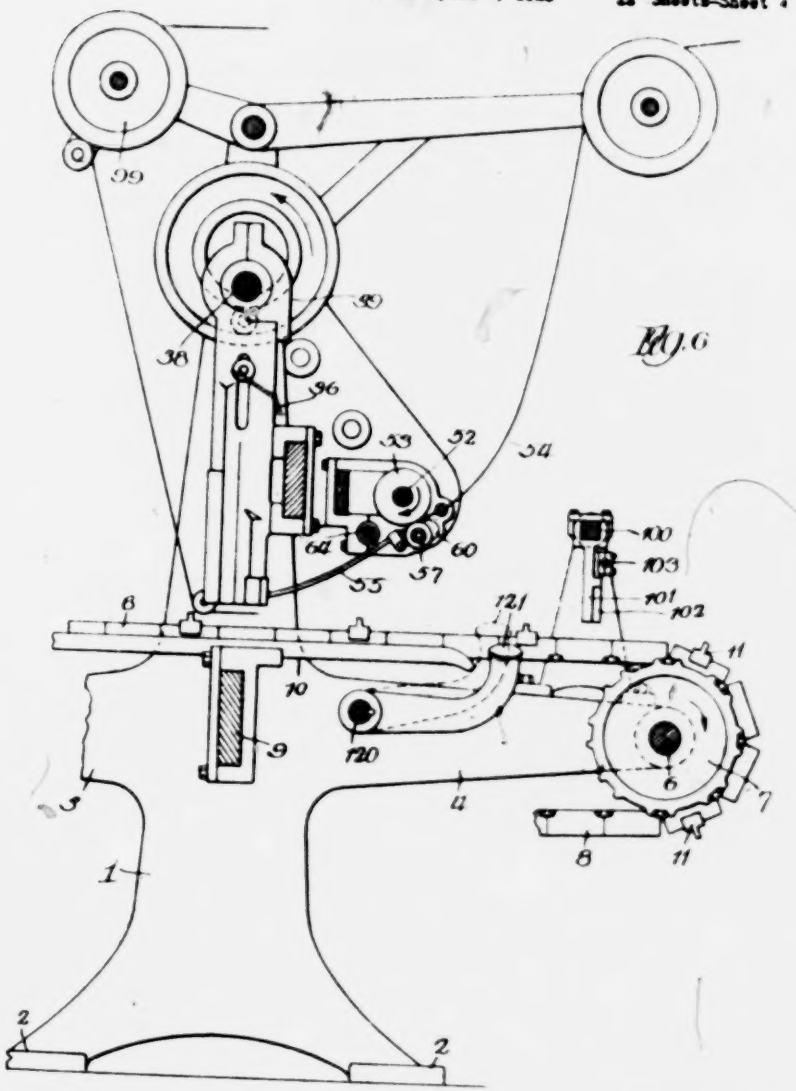


Fig. 6

Inventor:
Edward Craig
By Arthur H. Durant
Atty

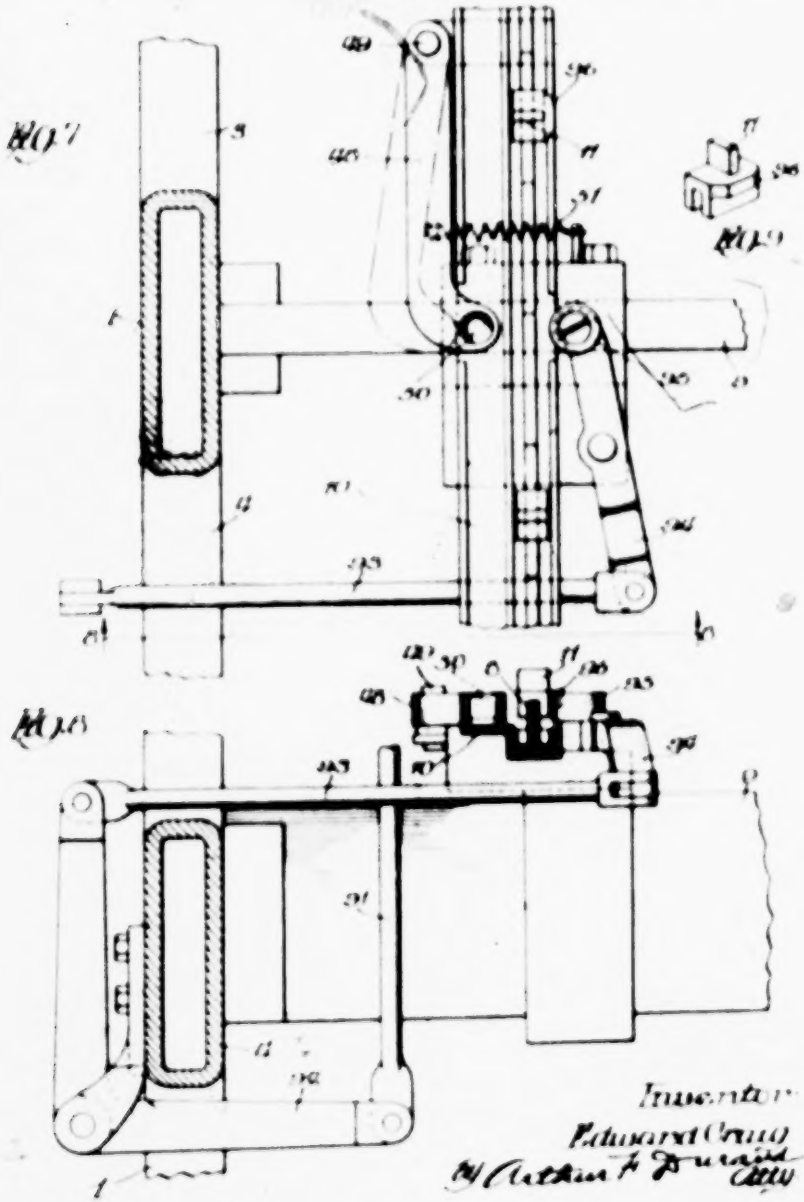
1883-1884

Sept. 29, 1925. 1,555,189

E. CRAIG

METHOD AND APPARATUS FOR MAKING WIREBOUND BOXES

Filed April 8, 1923 12 Sheets-Sheet 1



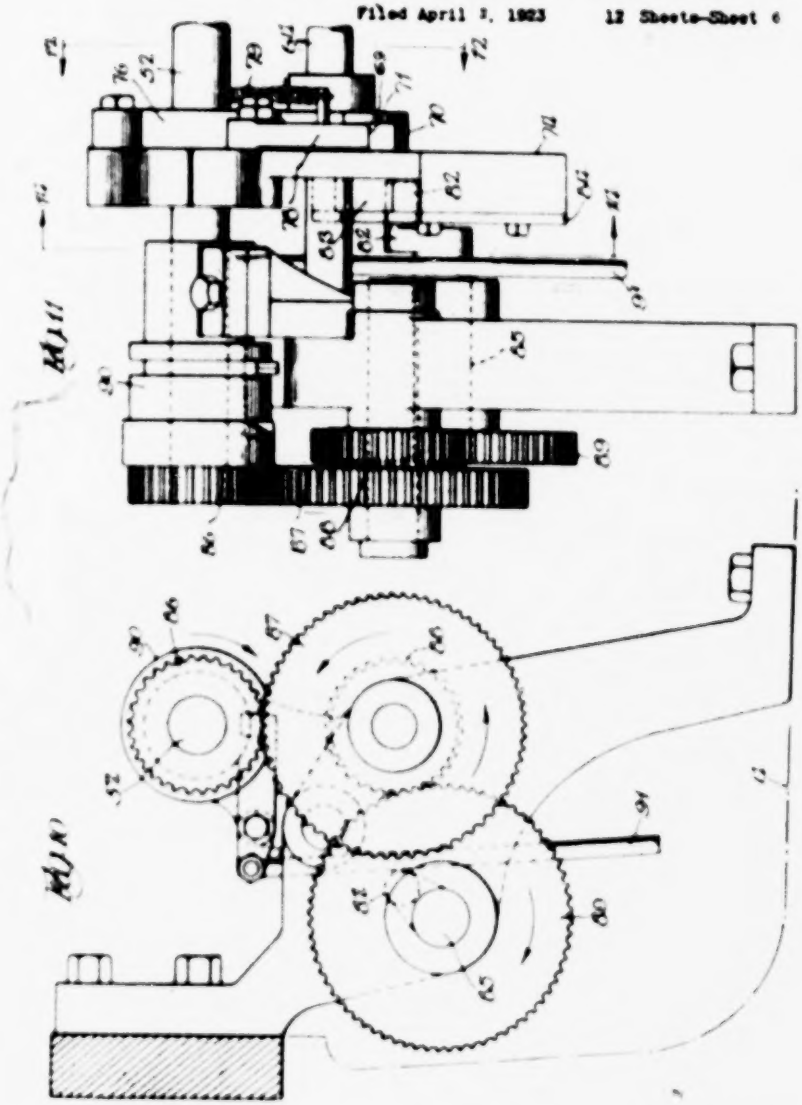
Inventor
Edward Craig
By Clarkson & Rowland
Atty

Sept. 29, 1925. 1,555,189

E. CRAIG

METHOD AND APPARATUS FOR MAKING WIREBOUND BOXES

Filed April 3, 1923 12 Sheets-Sheet 6



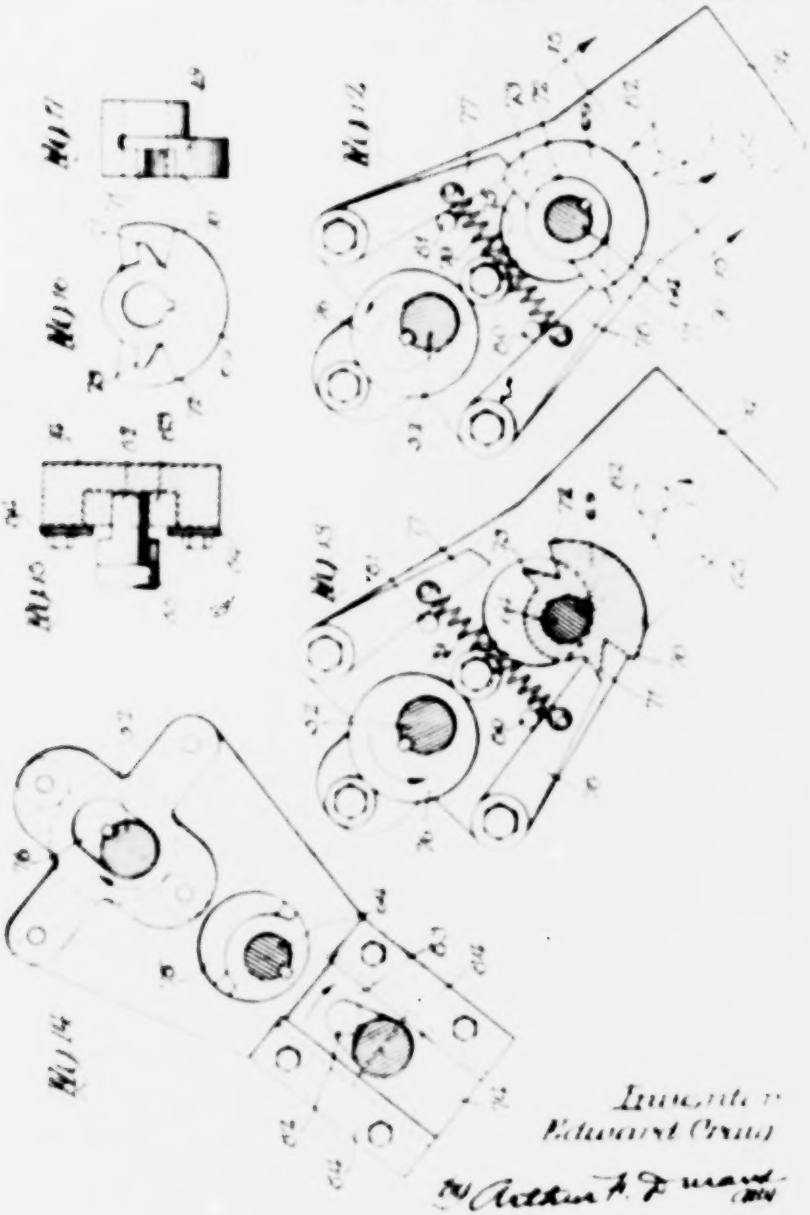
Inventor:
Edward Craig
By Arthur F. Durant
Atty

Sept. 29, 1925. 1,555,189

E. CRAIG

METHOD AND APPARATUS FOR MAKING WIREBOUND BOXES

Filed April 2, 1923 12 Sheets-Sheet 1



Inventor
Edward Craig
By Arthur H. Dumont
Atty

Sept. 29, 1925. 1,555,189

E. CRAIG

METHOD AND APPARATUS FOR MAKING WIREBOUND BOXES

Filed April 9, 1923 12 Sheets-Sheet 8

Fig 18

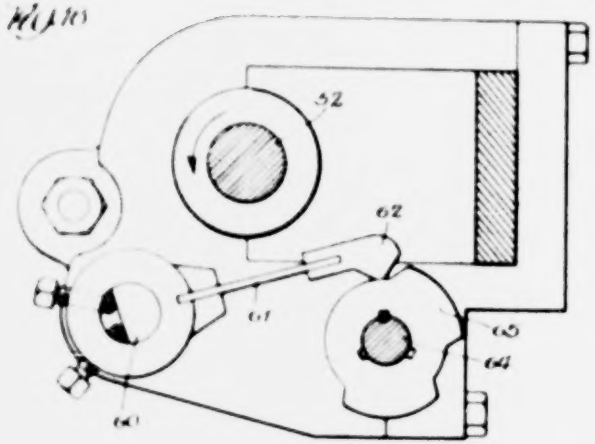


Fig 19

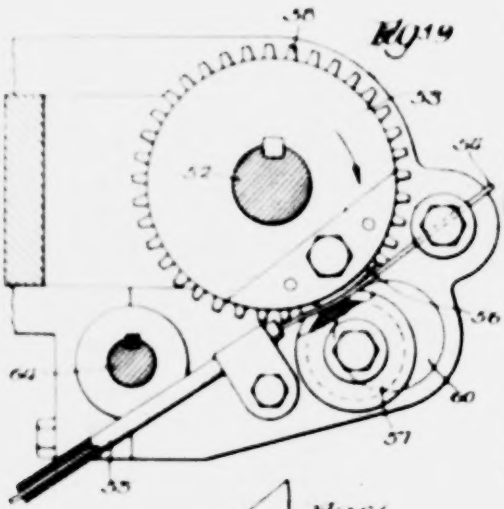


Fig 20

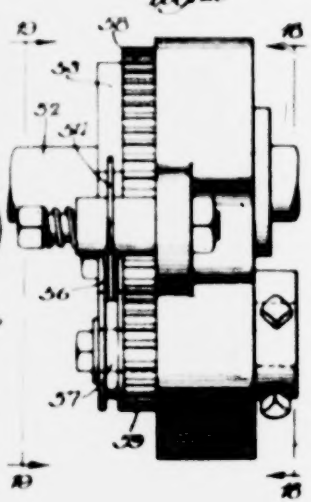


Fig 21

Inventor:
Edward Craig
by Arthur H. Durand
Atty.

1891-1892

Sept. 29, 1925. 1,555,189

E. CRAIG

METHOD AND APPARATUS FOR MAKING WIREBOUND BOXES

Filed April 2, 1923 12 Sheets-Sheet 9

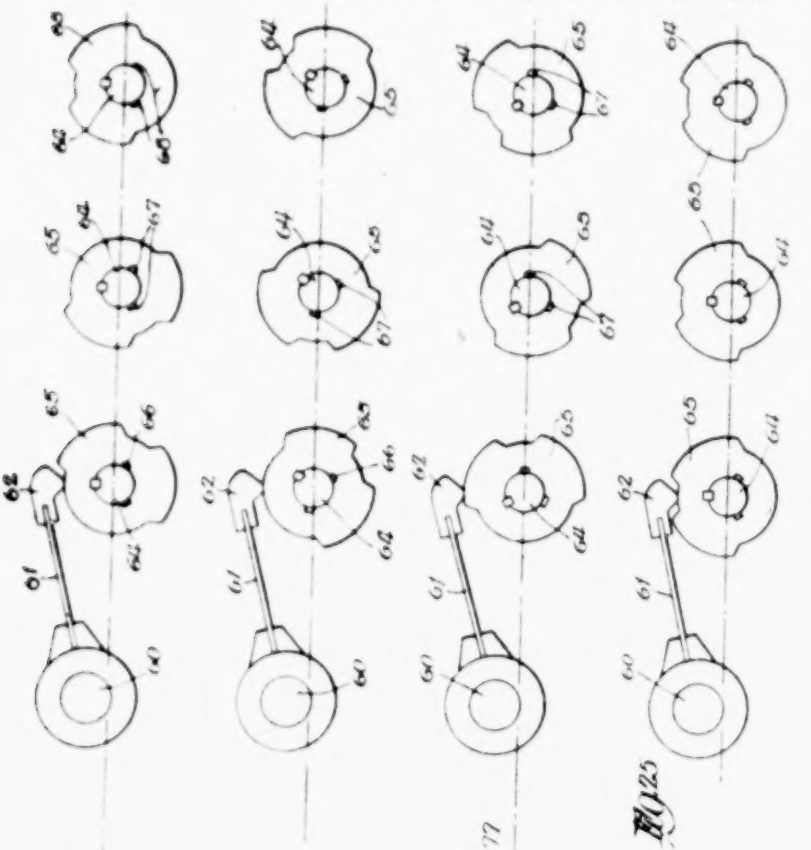


Fig 25

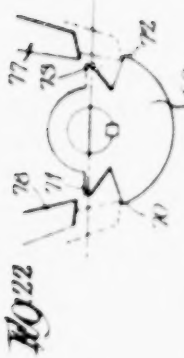


Fig 22

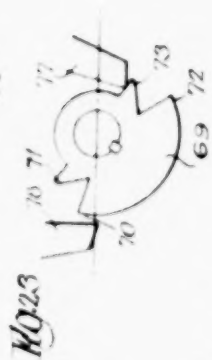


Fig 23

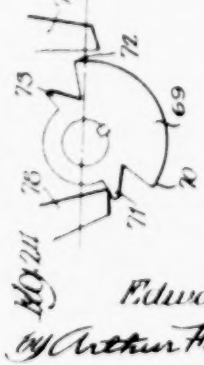


Fig 24

Inventor:
Edward Craig
By Arthur H. Durand
Atty.

Sept. 29, 1925.

E. CRAIG

1,555,189

METHOD AND APPARATUS FOR MAKING WIREBOUND BOXES

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Fig. 26

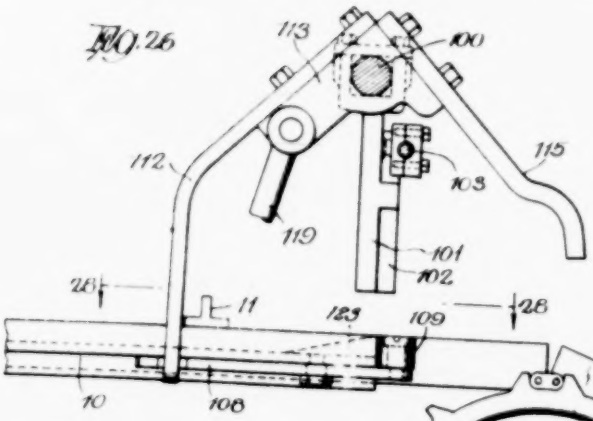
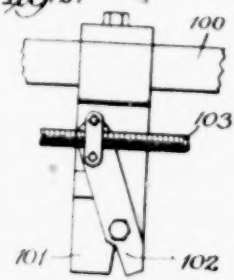


Fig. 27



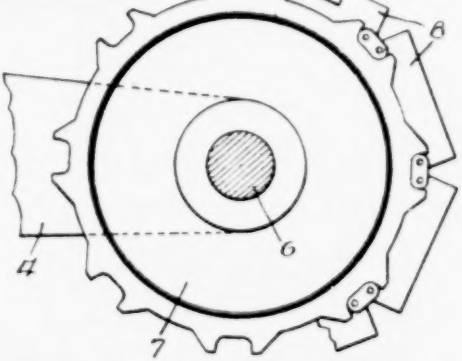


Fig. 28

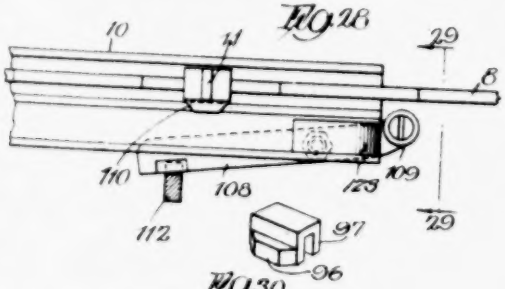


Fig. 29

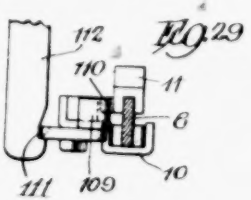


Fig. 30

Inventor:
Edward Craig
by Arthur F. Durand Atty.

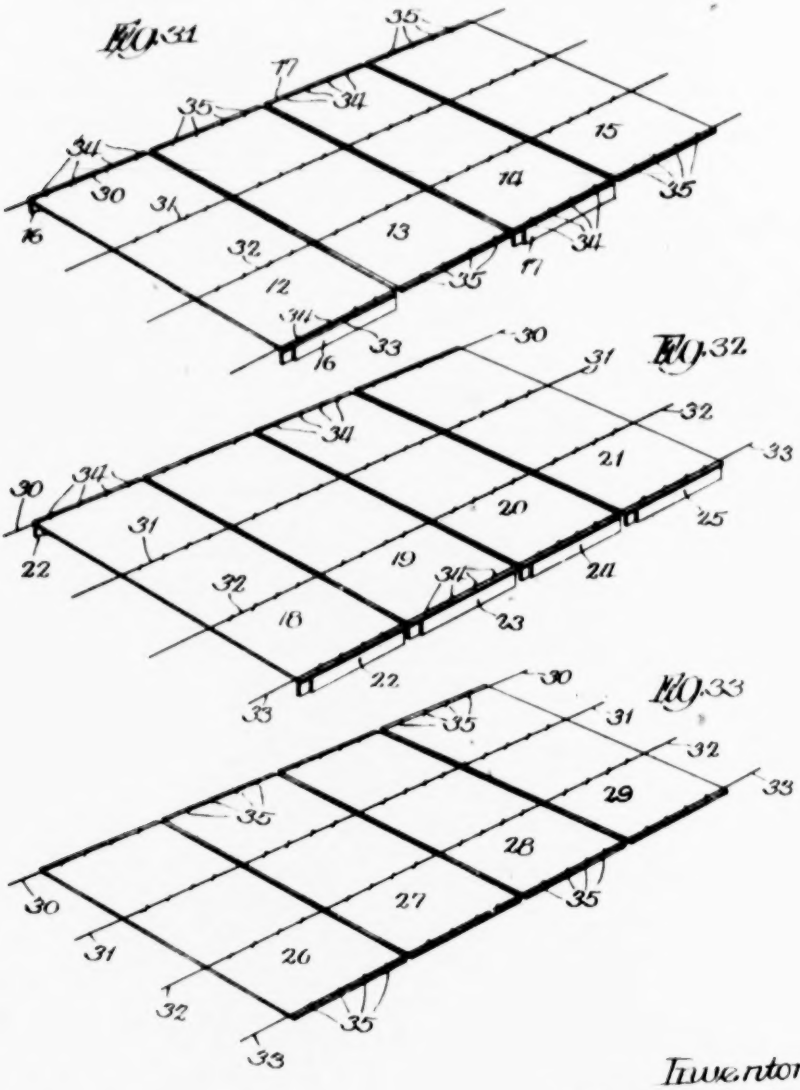
1895-1896

Sept. 29, 1925. 1,555,189

E. CRAIG

METHOD AND APPARATUS FOR MAKING WIREBOUND BOXES

Filed April 2, 1923 12 Sheets-Sheet 11



Inventor:
Edward Craig
by Arthur H. Durand Atty.

Sept. 29, 1925. 1,555,189

E. CRAIG

METHOD AND APPARATUS FOR MAKING WIREBOUND BOXES

Filed April 9, 1923 12 Sheets-Sheet 12

Fig 34

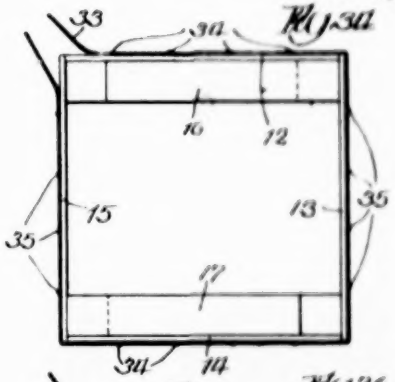


Fig 35

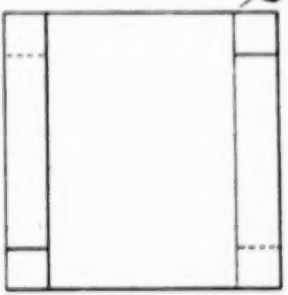


Fig 36

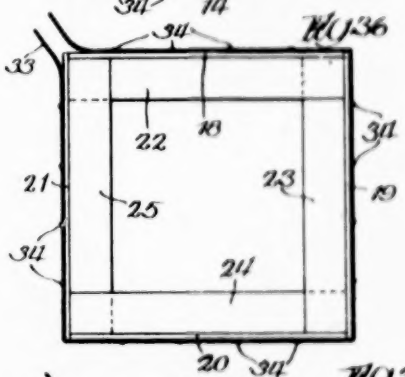


Fig 37

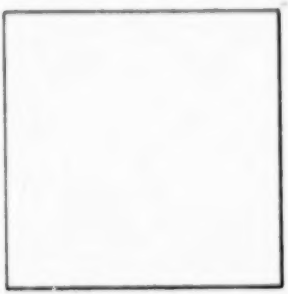


Fig 38

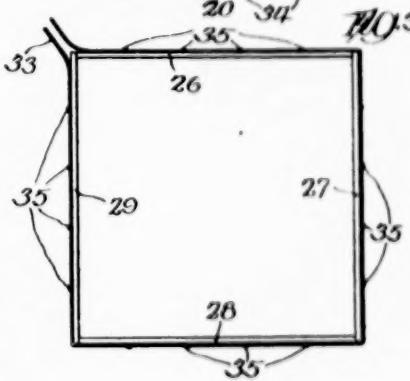
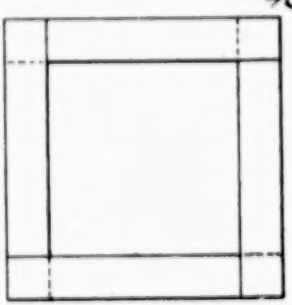


Fig 39



Inventor:
Edward Craig
by Arthur F. Durand
Atty

mon. The semi-cleatless blank, such as those having cleats only on every other section of the blank, are not susceptible of use in any satisfactory manner without the cleated heads or end walls which go with such blanks, and in this view of the case the semi-cleatless or semi-cleated blank, whichever it may be called, is not in a proper sense a box in itself. The invention relates, therefore, to the manufacture of any one or all of these different forms of box blanks.

Generally stated, the object of the invention is to provide an improved method and apparatus whereby wire bound boxes of this general class may be produced by the use of either cleatless or semi-cleatless or full-cleated blanks, in a more satisfactory and efficient manner, and whereby in the manufacture of boxes from any one of these different forms of box blanks the cleats necessary for the reinforcement of the heads or ends of the box, regardless of which form of blank is used, are all first attached to something else, either the end walls or the sections of the blank, before the binding wires are stapled to the cleats, to thereby obviate the necessity of using certain devices and methods which have heretofore been considered necessary or desirable in the manufacture of wire bound boxes of this general class, as will hereinafter more fully appear.

It is also an object to provide an improved construction and arrangement whereby a box blank machine of this general character may be employed, practically without any changes, to make either the cleatless blank or the semi-cleatless blank or the full-cleated blank, as may be desired, so that on one and the same machine the manufacturer may produce any one of these three different kinds of blanks.

It is also an object to provide a novel and improved construction of wire cutting mechanism adapted to operate without any downward movement thereof into position to cut the wires, but, to the contrary, adapted to operate by simply lifting the wires enough to bring them between the blades or jaws of the cutting devices, as will hereinafter more fully appear.

Another object is to provide an improved method and system and apparatus whereby a box blank machine of this general character may run at greater speed, with fewer

operatives or attendants, so that the box blanks will be made more rapidly than is ordinarily possible with a machine requiring several attendants or operatives to not only control the machine, but to place the sheets and cleats or other materials therein, and to provide a system and apparatus whereby the wiring of the sections of the box blank together, in the making of either a cleatless or semi-cleatless or full-cleated blank, does not involve the relative positioning of cleats and sheets, such relative positioning of the cleats and sheets being accomplished either before or after the wiring operation is performed. For example, as will hereinafter more fully appear, in accordance with this invention, a full-cleated blank, one comprising four sheets of veneer and two cleats on each blank, is made by first securing the cleats to the sheets, so that the sheets and cleats are relatively positioned in the proper manner, and by then wiring the previously cleated sheets together. Also, for example, in accordance with this invention, either some or all of the cleats may be first secured to the heads [fol. 1900] or end walls of the box, so that such cleats are not relatively positioned in relation to their respective sheets until after the wiring of all the sheets together to produce the blank.

Another object is to obviate the necessity of using certain things heretofore employed or considered necessary in the manufacture of boxes and box blanks of this kind.

It is also an object to provide certain details and features of construction and novel combinations tending to increase the general efficiency and the desirability of a wire bound box blank of this particular character.

To these and other useful ends, the invention consists in the matters hereinafter set forth and claimed, and shown in the accompanying drawings, in which,—

Fig. 1 is a rear end elevation of a box blank machine embodying the principles of the invention,—that is to say, an elevation looking toward the end of the machine from which the box blanks are discharged.

Fig. 2 is a side elevation of said machine, on a smaller scale, looking toward the side at which is located the train of gears which communicate power from the overhead stapler drive shaft to the rotary shaft below which carries the feed rolls for feeding the wire from which the staples are made, it being understood that these staples are driven to

secure the binding wires to the different sections of the blank.

Fig. 3 is a vertical section on line 3—3 in Fig. 2.

Fig. 4 is a plan of the hopper structure shown in Fig. 3 and in Fig. 2.

Fig. 5 is a vertical section on line 5—5 in Fig. 1.

Fig. 6 is a vertical section on line 6—6 in Fig. 1, it being understood that in both Fig. 5 and Fig. 6 the receiving end of the machine is shown broken away for convenience of illustration.

Fig. 7 is an enlarged detail plan view of certain elements of the machine, on a larger scale, showing a section of one of the endless feed belts, and showing the swinging clinch block or anvil, showing a section of one of the channel guides in which the cleats slide, and showing the pivoted controller which is engaged by cams carried on the link belt to automatically control a certain clutch hereinafter described.

Fig. 8 is a vertical transverse section on line 8—8 in Fig. 7.

Fig. 9 is a perspective of one of the sheet pushers and control cams which are carried on the link belts to push the sheets or sections of the blank.

Fig. 10 is an enlarged detail view of portions of the wire feed and automatic control devices, being in the nature of a side elevation of the parts shown in Fig. 11.

Fig. 11 is a rear elevation of the parts shown in Fig. 10.

Fig. 12 is a detail section on line 12—12 in Fig. 11, showing the parts in certain positions.

Fig. 13 is a similar view showing the parts in different positions.

Fig. 14 is a detail section on line 14—14 in Fig. 11.

Fig. 15 is a detail section on line 15—15 in Fig. 12.

Fig. 16 is a detail side elevation of the peculiarly shaped or double acting ratchet wheel shown in Figs. 12 and 13.

Fig. 17 is an edge view of the said ratchet wheel shown in Fig. 16.

Fig. 18 is an enlarged detail section on line 18—18 in Fig. 20, on a larger scale, illustrating the form of control exercised by the cam shaft over the wire feed devices which feed the staple wire to the staplers.

Fig. 19 is a section on line 19—19 in Fig. 20.

Fig. 20 is a side elevation of the mechanism shown in Figs. 18 and 19, looking to the right in Fig. 18, and looking to the left in Fig. 19.

Fig. 21 is a detail side elevation of the wire feed cam shown in Fig. 19, this being the portion of the feed wheel which engages the wire to feed the latter to the stapler.

Figs. 22, 23 and 24 are diagrammatic views illustrating different positions of the double ratchet control mechanism as shown in Figs. 12 and 13 and showing the different positions of the cams on the wire feed roll shaft which automatically control the wire feed devices to intermittently feed the wire in the desired manner, when the box blank machine is used for the making of what is called an intermittent cleat box blank, which is a blank having every other sheet provided with two cleats, and having no cleats on the other sections, this being what is called a semi-cleatless or a semi-cleated box blank.

Fig. 25 is a diagrammatic view illustrating certain control cam positions necessary when the cleatless and the full-cleated box blanks are made on the machine.

Fig. 26 is an enlarged detail side elevation of certain portions of the wire cutting mechanism shown at the left in Fig. 5, and shown at the right in Fig. 6, and showing one of the sprocket chains and a portion of one of the endless feed belts for feeding the sheets to the blank.

Fig. 27 is a rear elevation of the scissors blades and adjacent parts shown in Fig. 26.

Fig. 28 is a detail section on line 28—28 in Fig. 26.

Fig. 29 is a detail section on line 29—29 in Fig. 28.

Fig. 30 is a perspective of the cam block which is used on the belts or feed chains of the machine, if it be desired [fol. 1901] to have the cams mounted separately on the chains, instead of having the cams on the sheet pushers, as shown in Fig. 9.

Fig. 31 is a perspective of the alternate cleat blank, or semi-cleatless or semi-cleated blank, which may be made on the box blank machine shown and described, in accordance with the different objects of the invention.

Fig. 32 is a perspective of one of the full-cleated, or eight cleated blanks, which may be made on said box blank machine, in accordance with certain objects of the invention.

Fig. 33 is a perspective of one of the cleatless box blanks, or blanks which have no cleats at all, which may be made on

the box blank machine shown and described, in accordance with certain objects of the invention.

Fig. 34 is an end view of the alternate cleat blank folded into box form, but without the heads or end walls thereof.

Fig. 35 is a face view of one of the heads or end walls which are necessary in combination with the alternate cleat blank to form a box.

Fig. 36 is an end view of the full-cleated blank folded into box form, showing that this form of blank is a complete box in itself without heads or end walls, as it is common to use the full-cleated blank in this manner.

Fig. 37 is a side elevation of one of the plain or uncleated heads or end walls which may be used with the full-cleated box blank, if desired, when it is desired to close the ends of the box.

Fig. 38 is an end view of the cleatless blank folded into box form, to illustrate the manner of folding, it being understood, however, that this form of blank is in no sense a box in itself, it being uncleated and having no stability whatever without heads or end walls.

Fig. 39 is a face view of the full-cleated or paneled heads or end walls which are commonly employed with cleatless blanks to produce the ultimate boxes.

As thus illustrated, the invention comprises a body frame 1 provided with base portions 2 which stand on the floor, and having forwardly extending arms 3 and rearwardly extending arms 4 to support the transverse shafts 5 and 6, respectively. Sprocket wheels 7 are mounted on said shafts to carry the endless link belts 8, which latter are of any suitable character. The body frame is provided with rigid transverse members including a bar 9, and longitudinal guides 10 are suitably mounted on the body frame. Link belts 8 are disposed inside of these guides, as shown, and are provided with sheet spacers and pushers 11 of any suitable character. Now the machine is intended for the making of a semi-cleatless or semi-cleated blank of the kind shown in Fig. 31, or for the making of the full-cleated blank shown in Fig. 32, and is also adapted to make the cleatless blank shown in Fig. 33, and the guides 10 are disposed in position to receive the cleats necessary or desired for any form of blank. If the blank is to be made as shown in

Fig. 31, the four separate sections 12, 13, 14 and 15 are cut to the desired dimensions, and the cleats 16 and 17, two of each, are then made in the proper manner, with tongue and groove formation at their ends, cleats of this kind being very common. The sections 12 and 14 are then placed in a machine (not shown), and are secured to their respective cleats 16 and 17, two cleats on each sheet, by the insertion of staples or brads or nails or tacks, or anything else. The cleatless sheets 13 and 15, and the pre-cleated sheets 12 and 14, are then placed in the blank machine, with the spacers 11 between the edges of the sheets, and with the cleats 16 and 17 in the guides 10, the cleatless sections alternating with the cleated sections, as shown in Fig. 31 of the drawings. The machine is entirely dependent upon the sheets to propel the cleats, inasmuch as the work feeding and spacing means are arranged in position to prevent any portion thereof from extending into the path of the cleats, and in this way there are no cleat pushers whatever, but merely sheet spacers and pushers to engage the sheets and space them apart, whereby each sheet is individually propelled. On the other hand, if a blank of the kind shown in Fig. 32 is to be made, then the four sections of veneer or other sheet material 18, 19, 20 and 21 having pairs of cleats 22, 23, 24 and 25 are placed, with the spacers 11, between the edges of the sheets. In each case, regardless of the form of blank to be made, the binding wires 30, 31, 32 and 33, or any suitable number of wires, are secured to the top surface of the sheets to flexibly connect them together. Of course, when a blank of the kind shown in Fig. 31 is to be made, long staples 34 are driven through the sheets 12 and 14 to secure the wires 30 and 33 in place, and to secure these wires to the cleats 16 and 17, these long staples extending through the sheets into the cleats in the well known manner. The wires 30 and 33 are, however, secured to the cleatless sheets 13 and 15 by short staples 35, and these staples have their points clinched on the under surfaces of the two cleatless sheets. The staples for securing the intermediate wires 31 and 32 in place are of course short staples also, and are also clinched to the under surfaces of the two cleatless sheets. In Fig. 32, the wires 30 and 33 are everywhere secured in place by the long staples 34, as [fol. 1902] all of the sheets have cleats. In Fig. 33 all four

wires, or any suitable or desired number of wires, are secured in place by the short staples 35, inasmuch as none of the sheets are provided with any cleats, and consequently only short staples are necessary in the making of this particular blank. Therefore, the two outer staplers 36 are double staplers, each one adapted to drive either long or short staples, as fully disclosed in Patent No. 1,258,989 granted March 12, 1918, while the intermediate staplers 37 are adapted to merely drive short staples, and in this way either long and short, or short staples alone, or long staples alone are driven by the staplers 36 to secure the wires 30 and 33 in place, depending upon the character of the blank to be made. The staplers 37, however, operate always to insert short staples to secure the two wires 31 and 32 in place. These staplers are operated in the well known manner by a transverse shaft 38 through the medium of the connections 39, which latter may be of any suitable character, and this shaft 38 has an eccentric 40 which operates a reciprocating rod 41 connected at its lower end with a bell crank 42 on the side of the machine. A rod 43 having a turnbuckle 44 therein, is connected to the upper end of the arm 45, which pivots on the shaft 6 previously mentioned. This shaft has a ratchet wheel 46, and the arm 45 has a ratchet dog 47 to engage this ratchet wheel, whereby the endless work feeding chains or belts 8 are given a step by step or intermittent motion by the ratchet mechanism thus provided, when the shaft 38 is operated to actuate the staplers. Therefore, the blank materials are given a step by step feeding motion, below the staplers, and the latter insert the staples in the desired manner to form either a cleatless blank or a full-cleated blank or a semi-cleated blank or cleatless blank. For any cleatless sections of the blank, the pivoted arms 48 which are pivoted adjacent the guides 10 at 49, swing inward to present the clinch blocks or anvils 50 below the staplers which drive the short staples 35, so that these staples will be clinched on the under surface of each cleatless sheet or section of the blank. If a full-cleated blank is being made, these arms 48 are pushed out of the way by the cleats, so that they automatically stay out of the way, being subject to the tension of springs 51 which tend to pull them into the path of the cleats. If an alternate cleat blank is being made, then the

clinch blocks 50 swing into position below the sections 13 and 15 of such a blank, but are pushed out of the way by the cleats 16 and 17, in a manner that will be readily understood. On the other hand, if a cleatless blank is being made, then the clinch blocks 50 remain in the position in which they are shown, in the path of the cleats, or in the guides 10, as shown, inasmuch as only short staples 35 are driven for all sections of the blank. The guides 10 support the cleats, while the staples 34 are inserted to secure the binding wires thereto, but the cleats are held against endwise displacement by the sheets to which they have been previously secured, there being no portion of the work feeding instrumentalities which extends into the path of the cleats, whereby the machine is absolutely dependent upon the sheets to propel the cleats in their guides.

Now, it will be understood of course, that the length of the staples need not be changed, and that the same length of staple could be used for the cleatless sections, and for the cleated sections, and in that event no automatic changing from long to short, and from short to long, in the making of an alternate cleat blank, would be necessary. However, it is obvious that the cleatless sections do not require as long staples as is necessary for securing the wires to the cleated sections, inasmuch as these staples for the cleated sections cannot be clinched on their under surfaces, where they are driven into the cleats, and hence they must be longer to enable them to be firmly anchored against pulling out. Therefore as a matter of further and special improvement, the machine is preferably provided with a transverse rotary feed shaft 52 having feed rolls 53 thereon for the wires 54 which are to be fed to the tubes 55 leading to the staplers. These feed rolls have cam portions 56 which engage the wire and force the latter against the idler rolls 57, thereby to feed the wire, it being observed that the two rolls are geared together by the gear teeth 58 and 59 thereof. The rolls 57 are eccentrically mounted on the brackets 60, and these eccentric mountings are provided with tension arms 61 having engaging portions 62, and when these engaging portions 62 are raised the rolls 57 are pushed upwardly against the wires 54, so that the wire will feed forward as long as it is engaged by the cam portion 56, but will not feed forward while the rolls are rotating with the

portion 56 out of engagement with the wire. The rolls rotate continuously, but thereby produce an intermittent feeding motion of the staple wires 54, so that the latter are fed forward to the desired extent necessary to produce staples of the proper length. The shaft 52 is driven by a train of gears 63 from the shaft 38 previously mentioned. Therefore, when the stapler shaft 38 is driven, the staple wire feed rolls are also driven as well as the work feeding means previously described. To automatically control the staple wire feed devices thus provided, an oscillatory shaft 64 is [fol. 1903] provided, extending parallel with the feed roll shaft 52, as shown in Figs. 18 and 19, and upon this shaft 64 are mounted the cams 65, there being one cam for each engaging portion 62 previously mentioned. These cams are all of the same shape, but they are set differently on the shaft, except those for the intermediate wires 31 and 32 which are shaped in the particular form shown and described. Therefore, for each outside stapler 36, there are two of the cams 65, and these two cams are set on the shaft as shown in Figs. 22, 23 and 24, when it is desired to make an intermittent cleat box blank. In other words, the cam for the feeding device which is to feed the wire for the long staples, of each outside stapler, is held in place by keys 66, while the cam for the feeding device which is to feed the wire for the short staples, is held in place by the keys 67, the two cams being relatively positioned, as shown, for each outside stapler, but for each of the staplers 37 there is only one cam 65, which is positioned as shown at the right in the diagrams of Figs. 22, 23 and 24, these single stapler cams being held in place by keys 68 in the manner shown. The shaft 64 oscillates back and forth, with the result that the engaging portion 62 is alternately raised and lowered by the cam, thereby alternately gripping and releasing the wire 54 between the feed rolls. Therefore, by setting the cams 65 at different angles, as shown, the different wire feed devices can be automatically controlled to feed the staple wires at the proper time, and to the desired extent, and to oscillate the shaft 64 automatically controlled mechanism is employed comprising a peculiarly shaped double ratchet wheel 69 having two teeth 70 and 71 at one side, and having two similar teeth 72 and 73 at the other side. A sliding member 74 has an opening 75 to provide clearance

for the cam controlled shaft 64, and the wire feed roll shaft 52 has an eccentric device 76 by which this member 74 is reciprocated in the direction of its length. The two oppositely arranged ratchet dogs 77 and 78 are connected together by spring 79, and are normally held against stops 80 and 81, respectively. These ratchet dogs 77, 78 are for the purpose of engaging the ratchet teeth 70, 71, 72 and 73, previously mentioned, so as to oscillate the shaft 64 in the desired manner, during the operation of the machine, so that the two outside staplers will first drive long staples for a cleated section, and then short staples for the cleatless sections, in the desired manner. In order that the ratchet dogs 77, 78 may actuate the cam shaft 64 in the necessary manner, the member 74 is vibrated or swung back and forth at its lower end, by the crank 82 which engages the slide plate 83, the latter sliding in longitudinal guides 84 on the said member 74 previously mentioned. Thus, while the eccentric device 76 is reciprocating the member 74, the crank 82 is vibrating this member, thereby causing the dogs 77, 78 to take turns at actuating the double ratchet wheel 69, in the manner necessary to cause the cams 65 to properly control their respective tension arms 61, when it is desired to make an intermittent cleat blank, as is assumed for the purpose of the present illustration of the mode of operation of the machine. The crank 82 is on a shaft 85, which is operated from the wire feed shaft 52 through the medium of the gears 86, 87, 88 and 89, the latter being on the said shaft 85, and a clutch 90, of any suitable character, being interposed between the shaft 52 and the pinion gear 86 previously mentioned. This clutch is normally open, but each time it is closed, as will hereinafter more fully appear, the shaft 85 is given a one quarter turn or rotation. This clutch is controlled by a rod 91 which is connected to a bell crank 92 pivoted at one side of the machine. A rod 93 connects the upper end of this bell crank with a horizontally pivoted lever 94, which latter has a roller 95 disposed in position to be engaged by the cams 96 carried by some of the spacers 11 previously mentioned. Thus, whenever a cam 96 strikes the roller 95, the clutch 90 is closed, and the crank 82 will shift the slide 83 and move the member 74 in the desired manner, thus altering or changing the control of the ratchet dogs 77, 78 over the

ratchet wheel 69 previously mentioned, and causing a partial rotation of the shaft 64 to the extent necessary to stop the feeding of the wire to the staplers which drive the long staples, or vice versa, and to start the operation of the feeding devices which feed the wire to the staplers which drive the short staples, or vice versa, thus enabling the feeding motion of the endless work feeding chains to automatically control the action of the staplers, thereby to drive long staples in the cleated sections and short staples in the cleatless sections, in the manner described.

The tension arms 61 for the wire feed devices of the staplers 37 work up and down in unison, as their cams 65 are set exactly the same on the shaft 64; but each stapler 36 has, as previously stated, allotted to it two of the cams 65, one to control the feed rolls 53 and 57 which feed the wire for the long staples, and the other to control the feed rolls 53 and 57 which feed the wire for the short staples. With the automatic control mechanism shown and described, therefore, by arranging the cams 96 in suitable positions on the feed chain, no staples will be driven between blanks, as all of the staplers will be thrown out of action for this purpose; and, in order to prevent the driving of staples between the sections of the same blank, the [fol. 1904] engaging portions 62 of all the wire feeding devices will fall into neutral positions while the spaces between the sheets of the same blank are passing under the staplers. The cams 96 can be located on the spacers 11 to some extent, or all together, or some of these cams 96 may be located on the blocks 97 which have no propelling or spacing function on the link belt which controls the pivoted lever 94 in the manner described. In other words, these cams 96 can be located wherever necessary on the link belt to exercise the desired automatic control over the action of the staplers. The making of an intermittent cleat blank, as explained, is accompanied by oscillation of the cam shaft 64 to raise and lower the engaging portion 62, in the manner required by each stapler, thereby to alternate from long to short staples, and vice versa, during the stapling of the wires to the four sheets of the blank. Fig. 22 shows all of the cams in neutral position, so that the wires 54 are loose everywhere and will not be fed forward by the rotation of the feed rolls. Approximately, the

crank shaft 85 may rotate twice, or make two complete revolutions, for each blank being made. Also, the wire feed shaft 52, when four staples are driven in each section of the blank, as shown, may rotate approximately nineteen times for each blank, and for each rotation a staple will be driven, except that every fifth rotation represents a miss or non-driving action of the staplers, in order to prevent the driving of staples between the edges of the sheets or sections of the blank. Between blanks the wire feed shaft 52 will rotate several times, and each time will be a miss or a non-driving stroke of the staplers; the number of times will depend upon the space between the blanks, in order to insure wire ends of suitable length for twisting together at opposite ends of the blank, in the ultimate conversion of the blanks into boxes. In other words, in changing from one length of staple to the other, in making an intermittent cleat box blank, such as shown in Fig. 31, the cams 65 all reach neutral positions so that no wire whatever is fed for the making of any staples, and this prevents the driving of staples in the spaces between the sheets of the same blank. Also, when the end of the blank is reached, and before the front end of the next blank comes under the staplers, the cams 65 all remain in neutral position to permit the wire feed rolls to rotate several times without feeding any staple wire, thus absolutely preventing the driving of any staples between blanks.

It is also desirable, of course, to make blanks of the kind shown in Fig. 32, called the full or eight cleated blanks, and also blanks of the kind shown in Fig. 33, which latter are ordinarily called cleatless blanks. Fig. 25 is a diagrammatic view showing the arrangement of the cams on the shaft 64 when blanks of this kind are used, it being obvious that for either blank there is no changing from one length of staple to the other. If the full-cleated blanks are made, as shown in Fig. 32, then all long staples are driven; but if cleatless blanks of the kind shown in Fig. 33 are made, then all short staples are driven. It follows, therefore, that for the making of the blank shown in Fig. 32, the cams 65 for the wire feed devices which feed the wire for the short staples are taken off, leaving on the shaft 64 only the cams for feeding the wire from which are made the long staples driven by the outside staplers 36, and the cams 65 for the

staplers 37, all the remaining cams being set exactly alike, inasmuch as the control must be the same for each stapler in use at such time. On the other hand, when a blank of the kind shown in Fig. 33 is employed, then the cams 65 which control the feed rolls which feed the wire for the long staples, in the staplers 36, are taken off, and only the cams allotted to the staplers 36 which control the feeding of the wire for the short staples are left on the shaft 64, and in such case the cams 65 allotted to the staplers 37 remain on the shaft; and at such a time the cams on the shaft 64 all have the same position. Thus for the making of a full-cleated blank, such as shown in Fig. 32, the staplers 36 drive long staples all the time, in all the sections of the blank, while the staplers 37 drive only short staples, as they always do for any form of blank; and when a cleatless blank of the kind shown in Fig. 33 is being made, the staplers 36 drive only short staples, and the staplers 37 drive short staples, clinch blocks 98 or any suitable means, being provided to clinch the staples which are driven by the staplers 37 to secure the wires 31 and 32 in place on any of the blanks. It will be understood, of course, that the binding wires are supplied in any suitable or desired manner, as by feeding them from reels 99 suitably arranged over the machine, under the staplers, by any of the well known devices for this purpose, staplers which are constructed to attach binding wires being very old and very common in this art. Thus the binding wires exert a drag or back pull on the blanks, and this back pull of the wires is communicated successively to the different sections of the blank, inasmuch as each section of the blank is propelled individually and by its own propelling means, and no section of the blank is propelled by the section behind it, the propelling power being communicated individually to each and every section of the blank. The clutch 90, of course, can be of [fol. 1905] any suitable character, and does not need description, as any clutch control which can be operated by the rod 91 will serve the purpose for controlling the transmission of power from the shaft 52 to the gearing which operates the crank shaft 85 previously described.

Now it is also desirable to automatically sever the binding wires, between blanks, as they are discharged from the machine, and for this purpose the machine is provided with

a transverse support 100 upon which are rigidly mounted the downwardly extending ledger blades 101 of each cutting device, there being as many devices as there are binding wires. The pivoted or movable blades 102 are connected together by a transverse and endwise movable rod 103, and this rod is operated by a crank arm 104 which at certain times engages the end of the rod to simultaneously actuate all of the cutting devices. This crank arm 104 is mounted at the upper end of a vertically movable shaft 105, to the lower end of which is secured another crank arm 106 which is engaged at the proper time by an adjustable screw head 107 on the upper end of the rod 43 previously described. The portion 104 is too low to strike the end of the rod 103, each time the rod 43 is pulled backward, so that the cutting devices are not actuated while the four sections of a blank are traveling under the staplers. A horizontal lever 108 is pivoted as shown, and is provided with a roller 109 to be engaged by cams 110 on one of the feed chains. This lever 108 normally engages the notch 111 in the lower end portion of the arm 112 which is mounted on the bracket 113, which latter is mounted to oscillate on the shaft support 100 previously mentioned. A spring 114 connects the arm 112 with the body frame, in any suitable manner, and another arm 115 is secured to the bracket 113 in position to be engaged by the rollers 116 and 117 carried by the upper end portion of the rod 43 previously described. Now when the cam 110 strikes the roller 109, the lever 108 releases the arm 112, thereby permitting the spring 114 to pull the arm 112 backward. A pivoted lifter 118 is connected by a link 119 with the bracket 113, and this lifter engages and raises the arm 106 and the shaft 105 just enough to permit the arm 104 to assume a position directly opposite the end of the rod 103, so that upon the back stroke of the rod 43 the screw 107 will strike the arm 106 and cause the arm 104 to move the rod 103 endwise, to the right in Fig. 1, thereby to actuate all of the cutting knives 102, in a manner that will be readily understood. The shaft 120 upon which the lever 118 is mounted is provided inside the body frame with three other similar lifters 121 adapted to engage the under side of the blanks. Consequently, when the arm 112 is pulled backward by the spring 114, the lifters 121 raise the blank, and the operation is so timed that the wires between the ends of two blanks are raised into position between the

knives 101 and 102, of each cutting device, and at the same time the rod 103 is actuated as stated to operate the cutting devices to cut the wires. Immediately thereafter, upon the back stroke of the rod 43, the roller 117 strikes the arm 115, the lower end of this arm having been inserted between the two rollers 116 and 117 by the action of the spring 114, and this will restore the arm 112 and the lifters 118 and 121 to normal position, and will cause the lever 108 to again lock the arm 108 in normal position. Spring means of any suitable character (not shown) can be employed to yieldingly control the lever 122 in the desired manner, so that it will act as a spring control latch to lock the arm 112 in normal position. Similarly, spring means of any suitable character (not shown) can be employed to yieldingly maintain the elements 104, 105 and 106 in normal position, and to restore them to normal position after actuation in the manner explained. Only slight upward movement of the arm 104 is necessary, and comparatively slight swinging movement of this arm is necessary to actuate the cutting devices, in the manner explained. Therefore, the cutting devices are in fixed position, and are not lowered into the spaces between the blanks, but, to the contrary, the binding wires are elevated or lifted into position to engage such cutting devices at the proper time, thereby to sever the wires between blanks, and the wire cutting instrumentalities thus provided are then restored to normal condition to lower the blanks and permit them to be discharged from this end of the machine.

Now, with the foregoing method and apparatus, the feeding of materials from a hopper is rendered more practicable and certain than heretofore, to this extent. When sheets of veneer without any cleats are superposed in a hopper, and fed from the bottom of the stack, there is liable to be some difficulty because of warping of the sheets, and for other reasons, the sheets some times being rather thin. However, with the sheets precleated or reinforced by cleats secured thereto, in the manner explained, such sheets can be fed very readily from a hopper 122, arranged over the receiving end portion of the work-feeding and guiding means, with the cleats downward. These cleated sheets will be forced from the bottom of the hopper, one at a time, by the flights or pusher lugs on the endless chains or feed belts, so that the sheets will be fed automatically in their proper

relative positions on the work-conveying means. Of course, uncleated sheets can be fed and this automatic feeding [fol. 1906] scheme will work all right if the sheets are flat and substantially uniform in thickness. Precleating the sheets, however, keeps them flat and makes them easier to feed from the hopper.

In any event, however, as explained, the problem of relatively positioning the cleats relative to their respective sheets is solved outside of the blank-making operation, or wiring operation, as such relative positioning is accomplished either before or after wiring the sections together. For a full cleated blank the relative positioning of the cleats and sheets is all accomplished by the precleating of the sheets previous to the operation of wiring the sheets together. In the making of a semi-cleatless or alternate cleat blank such sheets as are cleated in the blank are supplied with their cleats before the operation of wiring the sheets together, so that the relative positioning of these cleats with respect to their allotted sheets is accomplished before the wiring operation is performed; but for the uncleated sheets of a semi-cleated blank the relative positioning of the cleats with respect to their allotted sheets, is accomplished after the wiring of all the sheets together, and in the conversion of the blank into the ultimate box. On the other hand, in the making of boxes from cleatless blanks, the sections of the blank are all wired together before the cleats are properly related to their respective sheets, as the cleats have all been previously secured to the heads or end walls, and under such circumstances the cleats are all relatively positioned in proper relation to their respective sheets after the wiring of the sheets together, and during the conversion of the cleatless blank into the ultimate box.

The method or process, it will be seen, is designed more particularly for use in the making of wire bound box blanks by machinery, inasmuch as the cleating of the sheets, or some of them, before they enter the machine, obviates the necessity of employing any cleat propelling or positioning means for the cleats thus previously secured to any sheet. In other words, one of the objects of the cleating of the sheets, or some of them, before they enter the machine, is to obviate the necessity of using cleat pushers or cleat spacers in the operation of the blank making machine, or to minimize or reduce the use of cleat pushers or cleat spacers

in such machine. It is also an object to speed up the operation of the machine, by obviating the necessity of employing attendants to place the cleats and sheets separately in the machine, for it is much easier for the attendants to place the cleated sheets in the machine, very obviously, than it is to place separate cleats in the machine and then place sheets in proper position thereon. By previously cleating the sheets, before they enter the machine, the sheets themselves become the means for feeding the cleats before the binding wires are attached thereto, and the sheets become the vehicle or medium by which the cleats are carried automatically into proper position in the machine. In other words, by placing a cleated sheet in the machine, the cleats automatically, so to speak, are carried into position, and are made to assume their proper positions without special effort or attention for that purpose, as the placing of the sheet in the machine automatically positions the cleats.

It will be seen that the feature of individually propelling the sheets, so that the sheets propel any cleats which are employed for the blank, contemplates a machine for stapling wires to previously cleated sheets, or to cleatless sheets, depending upon what sort of blank is desired, and likewise contemplates a method for attaching wires to previously cleated sheets, while the sheets are being held in spaced relation, in a method in which the apparatus employed is operative to individually propel the sheets. Thus the work feeding means of the machine call for previously cleated sheets, if cleated blanks are to be made, as the machine has no means for feeding or propelling cleats, and the method or process involved in the manufacture of box blanks by machinery in this manner contemplates the attaching of wires to previously cleated sheets held in spaced relation and individually propelled in such relation to receiving the binding wires and the staples by which the wires are attached to the sheets.

As shown in Figs. 26 and 28, the roller 109 would be in the way of any cleats sliding in the guides 10, but by employing wedge-shaped blocks 123 in the ends of the guides, with their inclined surfaces upward and sloping toward the oncoming cleats, it is obvious that the cleats will be elevated sufficiently to ride over the roller 109 without interference.

Thus the spacing apart of sheets serves automatically to relatively position some cleats, preferably at least four

cleats for each blank, but it is obvious that any suitable number of cleats can thus be automatically positioned in the blank, preliminary to the wiring thereof, by the spacing apart of the sheets.

The machine has sheet spacers 11 for spacing the sheets, and these sheet spacers function to relatively position the cleats of one or more sections of each blank. Thus there are sheet spacers which not only have the function of spacing the sheets apart, and of feeding the sheets or sections of the blank individually, so that the back pull of the binding wires cannot be communicated from one sheet or section to another, but which also have the additional function of positioning some of the cleats of each blank. These [fol. 1907] spacers 11 individually feed the sheets or sections and thus the cleats of any precleated section or sections of the blank are dependent for their feeding motion and their proper positioning in the blank upon the sheet spacers or sheet feeders which engage the rear edges of the sheets or sections of the blank. In this way the said elements 11, or some of them, each have three functions. First the individual feeding of the sheets, second spacing the sheets apart, and third the positioning and feeding of some of the cleats of each blank, when a cleated or a semi-cleated blank is made. In this way, the necessity of using any cleat spacers, or even cleat pushers, is obviated and avoided by these methods, and in a machine of this kind either a cleated or semi-cleated or a cleatless blank may be made when desired and on one and the same machine and without changing the construction of the machine.

What I claim as my invention is:

1. A method for making wire bound box blanks by machinery, comprising the feeding of sheets and cleats along in a machine for fastening binding wires to the sheets, so that the cleats, or some of them, are carried by the sheet material, inserting staples through sheets and into cleats, to secure the wires to sheets and cleats by said staples, and to flexibly connect the different sections of the blank together, while maintaining the edges of the sheets in spaced relation during the forward feeding motion in said machine, thereby automatically positioning two or more cleats of each blank by the spacing apart of the sheets, so that the wiring of the sheets together in spaced relation is accom-

plished entirely after some cleats have been previously secured to sheet material, and whereby the wiring of the sheets together with their edges spaced apart is accomplished in a manner to obviate the necessity of providing said machine with means for positioning the cleats, or some of them, and propelling each sheet individually in a manner to prevent compression of the sheets together in the plane thereof, so that the predetermind spacing of the sheets and the resulting predetermined relation thereto of the cleats of one or more sheets is maintained during the wiring operation, whereby at least some cleats have the binding wires stapled thereto while held in position by the sheet or sheets to which they were attached before the operation of wiring the spaced sheets together.

2. The method as specified in claim 1, the cleats being previously attached to each and every section of the blank, whereby in the wiring operation the cleats are held end to end by their respective spaced sheets, and so that the spacing of the sheets serves automatically to position all of the cleats of the blank.

3. The method as specified in claim 1, at least two sheets of each blank having cleats rigid therewith before the wires are secured thereto, so that the spacing of the sheets apart serves to distance at least two cleats apart at each side edge of the blank.

4. The method as specified in claim 1, at least four sheets of each blank having cleats rigid therewith before the wires are secured thereto, so that the spacing of the sheets apart serves to distance at least four cleats apart at each side edge of the blank.

5. A machine for making wire bound box blanks by securing wires to previously cleated sheets, whereby each blank will have separate sheets bound together by parallel binding wires, with reinforcing cleats for one or more sheets, comprising instrumentalities for feeding the sheets forward and spacing them apart at their edges, with the desired number of cleats on one or more of the sheets, by engaging the rear edges of the sheets only, and with said instrumentalities disposed in position to prevent any portion thereof from projecting into the path of the cleats, so that

the machine is dependent upon the sheets to propel the cleats forward, and whereby said instrumentalities have both spacing and propelling engagement with each and every sheet, means for supplying binding wires to the surface of the sheets, and staplers for inserting staples to secure said wires to the sheets to flexibly connect them together in spaced relation.

6. A structure as specified in claim 5, said instrumentalities comprising endless feed belts having lugs thereon for insertion between the sheets, so that each lug must function not only as a combined sheet pusher and spacer, but also as a binding wire puller, as well as indirectly through the sheets to propel any cleats desired for the blank.

7. A machine for making wire bound box blanks by wiring either cleatless or precleated sheets together, to form a flexible blank, comprising work feeding and guiding means adapted to receive cleats and sheets for either a semi-cleated or a full-cleated blank, said feeding means requiring the precleating of one or more sheets of each blank, and adapted also to receive sheets for a blank without any cleats, said work feeding means being adapted to space and hold the sheets in spaced relation, so that the sheet spacing means serve also to relatively position and propel two or more cleats of each blank, means for supplying binding wires to the surface of the sheets, staplers for inserting staples to secure the wires to the sheets and cleats, means to clinch the staples on the under side of any sheets which have no cleats, adapted to move out of the path of any cleats desired for the blanks, feed mechanism to feed wire [fol. 1908] to said staplers to form the staples, and devices governed by the forward feeding motion of the blank materials to automatically control said means for feeding the wire to the staplers, thereby to automatically govern the action of the staplers in accordance with the cleated or cleatless character of the blanks to be made, said work feeding means being disposed in position to prevent any portion thereof from extending into the path of the cleats which travel in said guiding means.

8. A machine for making wire bound box blanks by wiring either cleatless or precleated sheets together, to form a flexible blank, comprising work feeding and guiding means

adapted to receive cleats and sheets for either a semi-cleated or a full-cleated blank, said feeding means requiring the precleating of one or more sheets of each blank, and adapted also to receive sheets for a blank without any cleats, said work feeding means being adapted to space and hold the sheets in spaced relation, so that the sheet spacing means serve also to relatively position and propel two or more cleats of each blank, means for supplying binding wires to the surface of the sheets, staplers for inserting staples to secure the wires to the sheets and cleats, means to clinch the staples on the under side of any sheets which have no cleats, adapted to move out of the path of any cleats desired for the blanks, feed mechanism to feed wire to said staplers to form the staples, and devices governed by the forward feeding motion of the blank materials to automatically control said means for feeding the wire to the staplers, thereby to automatically govern the action of the staplers in accordance with the cleated or cleatless character of the blanks to be made, said work guiding means comprising parallel guides for the cleats, and said work feeding means comprising parallel endless link belts having sheet pushers and spacers thereon arranged entirely between the two guides, thereby to prevent any portion of the work feeding or propelling means from extending into the path of the cleats.

9. A box blank machine for stapling sheets to cleats, wire feed mechanism for feeding wire for relatively long staples for cleated sheets, mechanism for feeding wire for relatively short staples for cleatless sheets, work feeding means, a controller actuated by the forward feeding motion of said work feeding means, a clutch controlled by said controller, a shaft having means thereon to control the action of said wire feeding means, and means controlled by said clutch to control the action of said shaft, thereby to determine whether long or short staples shall be driven in said sheets.

10. A structure as specified in claim 9, said work feeding means comprising an endless feed belt having blocks thereon to position the sheets, and means on said blocks to engage the controller, in combination with means for sup-

plying binding wires in position to be fastened to the work by the long staples or by the short staples or by both.

11. A structure as specified in claim 9, said work feeding means comprising an endless feed belt having means for spacing the sheets, and having means to engage said controller, in combination with a movable clinch block for movement into position to clinch the short staples, and adapted to move back out of the way of any materials into which the long staples are driven.

12. In a box blank machine for stapling wires to sheets, and for wiring the different sections of the blank together, the combination of a stationary cutting device to cut the binding wire between blanks, automatic means for lifting the wire into operative engagement with said cutting device, and means for automatically operating said device to cut the wire.

13. A structure as specified in claim 12, in combination with means for feeding the blank materials in a plane below the operative position of said cutting device, and means whereby the action of said cutting device, when the wire is lifted thereto is controlled by the actuation of said work feeding means.

14. A structure as specified in claim 12, in combination with work feeding means for feeding the blank materials, and means whereby said means for lifting the wire are automatically controlled by the actuation of the work feeding means

15. A structure as specified in claim 12, in combination with means including a ratchet mechanism for feeding the blank materials forward, and means whereby said cutting device and said lifting means are automatically controlled by the action of said ratchet mechanism.

16. A structure as specified in claim 12, in combination with means for locking said lifting means in normal position, work feeding means having provisions for tripping said locking means, means for automatically operating said lifting means when unlocked by the feeding motion of the work feeding means, and means for automatically locking the lifting means in normal position after the cutting of the wire.

17. The improved method of stapling wires to previously cleated sheets, for making box blanks by machinery, each blank having sheets and cleats and parallel binding wires, comprising the feeding of all of the sheets and cleats along in a stapling machine, with the sheets in spaced relation and under individual feeding pressure, and with one or more sheets previously cleated, so that the spaced sheets perform [fol. 1909] the function of relatively positioning some cleats, previous to the fastening of wires to the sheets, thereby obviating the necessity of providing said machine with means for positioning or feeding the cleats, or some of the cleats, and stapling the wires to the sheets and cleats.

18. Apparatus for making box blanks having cleats and sheets and parallel binding wires, comprising work-feeding instrumentalities for individually feeding and propelling the different sections of the blank, means for supporting said instrumentalities in position to prevent any portion thereof from extending into the path of cleats, so that the apparatus is dependent upon the individually propelled sheets to propel the cleats attached thereto and means for securing binding wires to the individually propelled sheets, by the insertion of staples through the sheets and into the cleats.

19. A method for making wire bound box blanks by machinery, comprising the spacing of the sheets apart and feeding them in spaced relation in a stapling machine, so that each sheet is propelled by forward feeding motion communicated directly thereto by the feeding means of said machine, with cleats carried by one or more of the sheets of each blank, and stapling binding wires to the sheets and cleats by the operation of said machine, thereby wiring the sheets together while held in spaced relation by the feeding means of said machine, thereby automatically positioning at least two cleats in each blank by the spacing apart of the sheets, and whereby the cleats, or some of them, are moved forward by one or more sheets before the wires are stapled thereto, thus obviating the necessity of using in said machine any feeding or positioning means for engaging the cleats which are carried by their sheets.

20. A method as specified in claim 19, in which each and every sheet of the blank is equipped with cleats secured

thereto, so that all of the cleats of the blank enter the machine with their respective sheets, and whereby said machine is equipped with sheet positioning and spacing and feeding means only, and no portion of said feeding means is required to project into the path of the cleats, inasmuch as all of the cleats of the blank are carried and propelled by their respective sheets before the wires are stapled thereto.

21. A method as specified in claim 19, in which all of the cleats of the blank are rigid with their respective sheets, before the wires are secured thereto in said machine, whereby no portion of the feeding and positioning means of said machine is required to project into the path of the cleats, and whereby all of the cleats of the blanks are carried by and propelled by their respective sheets before the binding wires are stapled thereto.

22. The method herein described of making wire bound box blanks of that type embodying a plurality of sheets flexibly bound together by wires, one or more of the sheets being provided with cleats, consisting in power-feeding the sheets in succession, in spaced relation, with cleats previously attached to one or more sheets of each blank, laying the wires continuously on the sheets as they are fed and stapling them thereto, whereby some cleats are attached to one or more of the spaced sheets before the wires are attachd thereto, the staples entering the cleats, the propelling force being applied separately to the back edge of each sheet, whereby the crowding or jamming of the sheets together is prevented and the cleats, or some of them, are carried forward through the medium of the sheets which carry them, and obviating the use of feeding or positioning means for any cleats which are rigid with one or more sheets before the wires are stapled thereto.

23. The method specified in claim 22, the propelling means applied to the rear edges of the sheets serving also to space the sheets.

24. The process of making a wire bound box blank consisting in assembling a sufficient number of precleated sheets to form the box blank, spacing the sheets by suitable means, individually propelling the sheets whereby compression of the sheets in the plane thereof is prevented, and wiring said sheets together as they are so propelled.

25. The method of making a wire bound box blank, comprising the successive wiring together of successive sheets, with cleats previously attached to one or more sheets, while maintaining a pull on the wires, keeping the sheets in spaced relation, preventing the pull of the wires from exerting any thrust through one sheet to another, whereby the spacing and individual positioning of the sheets prevents the pull of the wires from being communicated from one sheet to another and serves automatically to relatively position some cleats of the blank.

26. A machine for making wire bound box blanks by wiring sheets and cleats together, comprising work positioning means requiring the precleating of one or more of the sheets of each blank, and adapted for individually holding the sheets and spacing them apart, together with instrumentalities to staple the binding wires to the spaced sheets of each blank, and to cleats thereof, said holding means preventing the pull of said wires from being communicated from one sheet to another.

27. The method of making a wire bound box blank, comprising the spacing of the sheets or sections of the blank [fol. 1910] apart, by interposing spacers between said sections, with cleats previously attached to one or more sections, thereby using the sheet spacers to relatively position the cleats of one or more sections of each blank, thus obviating the use of spacers between the cleats, communicating power through said spacers to feed the sheets forward in unison and thereby cause one or more sheets of each blank to feed any previously attached cleats thereof, so that such spacers have the triple function of spacing the sheets, feeding the sheets, and feeding and positioning the cleats of one or more sections of each blank, and wiring the sections of the blank together as they are fed by the sheet spacers.

Edward Craig.

(Here follow side folios 1911-1916.)

DEFENDANT'S EXHIBIT NO. 21.

1912

Nov. 17, 1925. 1,562,413

E. CRAIG

METHOD OF MAKING WIREBOUND BOX BLANKS

Filed June 28, 1924 3 Sheets-Sheet

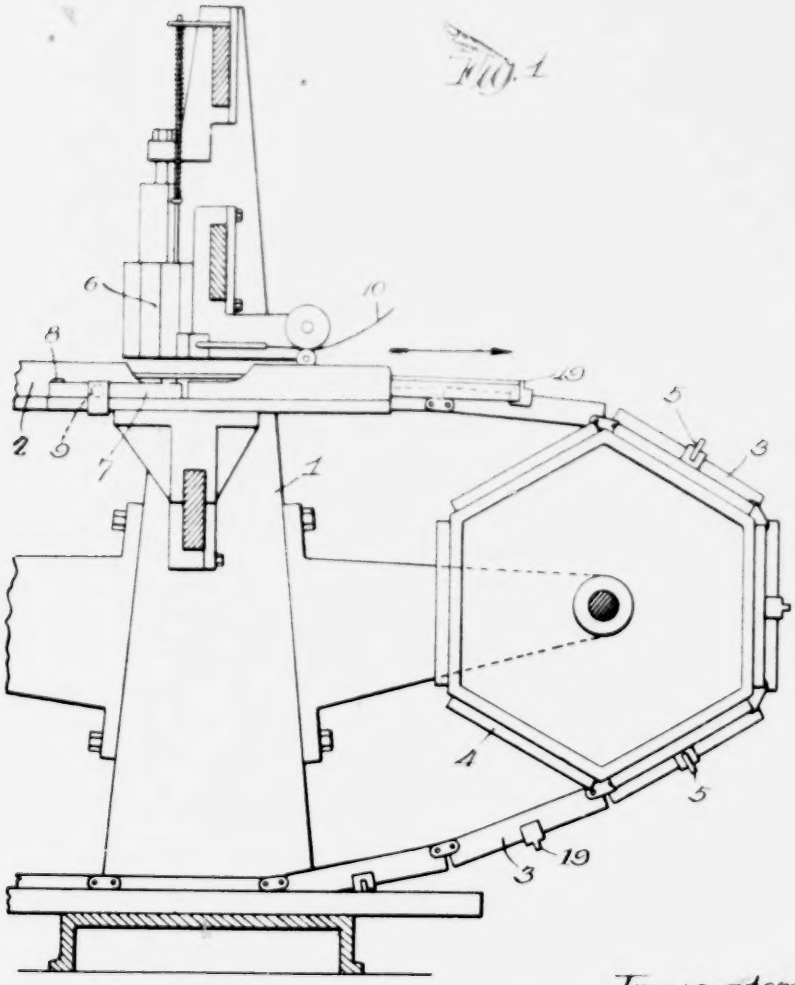


Fig. 1

Inventor
Edward Craig
By Arthur H. Durand Atty.

Nov. 17, 1925. 1,562,413

E. CRAIG

METHOD OF MAKING WIREBOUND BOX BLANKS

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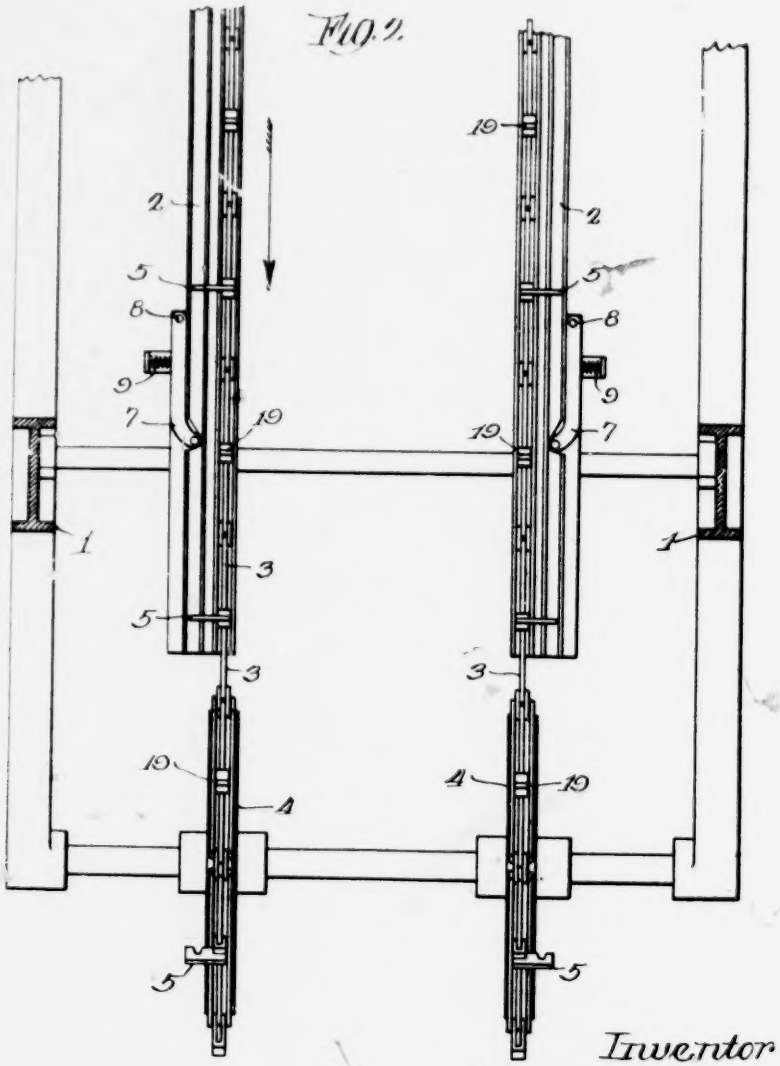
FIG. 2.



Inventor
Edward Craig
By Arthur H. Durand Atty.

1915-1916

Nov. 17, 1925. 1,562,413

E. CRAIG

METHOD OF MAKING WIREBOUND BOX BLANKS

Filed June 28, 1924 3 Sheets-Sheet

Fig. 3

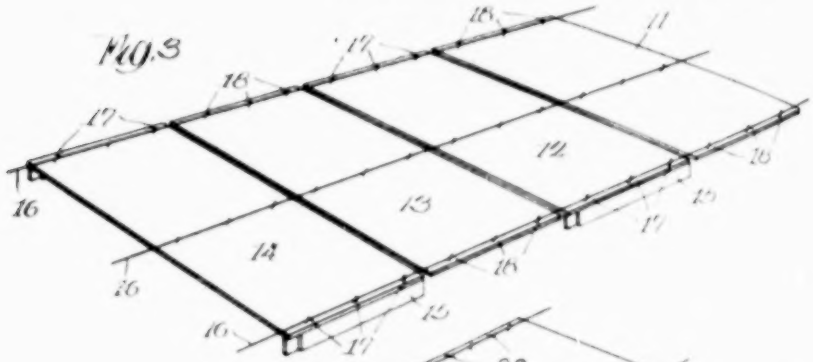


Fig. 4

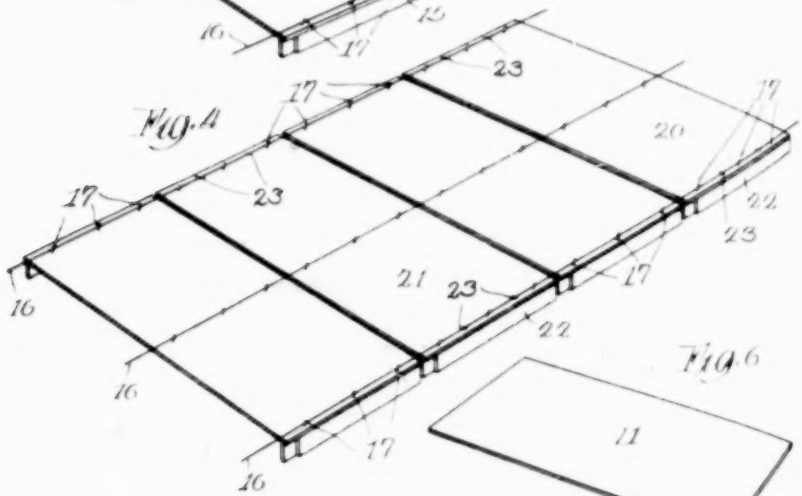


Fig. 6

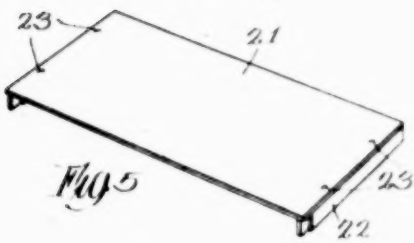


Fig. 5

Fig. 7

Inventor:
Edward Craig
By Arthur A. Durand
Atty.

Patented Nov. 17, 1925. 1,562,413

[fol. 1917] United States Patent Office

Edward Craig, of St. Joseph, Michigan, Assignor to Saraaac Automatic Machine Corporation, of Benton Harbor, Michigan, a Corporation of Delaware

Method of Making Wirebound-Box Blanks

Application filed June 28, 1924. Serial No. 723,058

To all whom it may concern:

Be it known that I, Edward Craig, a citizen of the United States, and resident of St. Joseph, Berrien County, Michigan, have invented a certain new and useful Improvement in Methods of Making Wirebound-Box Blanks, of which the following is a specification.

This invention relates to the manufacture of wire-bound box-blanks for the production of wire-bound boxes of that kind in which the sides or sections or sheets of the blank are reinforced, or some of them, by means of cleats secured thereto, and are flexibly connected together by parallel binding wires which are stapled to the sheets and the cleats, so that each blank is foldable into box form.

More particularly, the invention relates to the muanufacture of wire-bound blanks by machinery of that kind in which means are provided for propelling or feeding cleats along with the other materials, for one or more of the sheets of each blank, so that each blank will have one or more cleated sections, as well as, one or more cleatless sections. In the use of machinery of this kind, the sheets and cleats are delivered in any suitable manner to the work feeding means for feeding the sheets and cleats forward below the staplers, and for this purpose endless belts or sprocket chains are usually employed, and guides are provided for the cleats. The said belts or sprocket chains, however, are ordinarily provided with sheet spacers, or projections which extend between the sheets, to properly space the sections of blanks apart, and said belts or chains are also provided with cleat pushers for engaging and propelling the cleats along the guides, whereby the staples which are driven by the stapling mechanism to secure the binding wires in place serve also to attach the cleats to their respec-

tive sheets or sections of the blank. Ordinarily, the staples which are employed for securing the wires to sheets having cleats are longer than the staples which are driven to secure the wires to the cleatless sheets. In this way each blank is provided with one or more cleated sheets, and with one or more cleatless sheets, depending on the number of cleat pushers employed on said belts or sprocket chains to feed the cleats.

Generally stated, the object of the invention is to provide an improved process or method whereby machinery of the foregoing general character may be employed for the manufacture of wire-bound box blanks having cleats on each and every sheet or section thereof, or having cleats on more sections thereof than is called for by the number of cleat pushers on the feed belts or sprocket chains, so that either a partially cleated blank or a full-cleated blank, for example, may be made on one and the same machine, without changing the number of cleat pushers thereon, and practically without making any alteration in the machine itself.

It is also an object to provide certain details and novel method features and combinations of steps tending to increase the general efficiency and the desirability of a wire-bound blank method or process of this particular character.

It is also an object to obviate the necessity of using certain things heretofore considered necessary in the production of wirebound-boxes.

To the foregoing and other useful ends, the invention consists in the matters hereinafter set forth and claimed, and shown in the accompanying drawings, in which—

Fig. 1 is a longitudinal, vertical section of a wire-bound box blank machine of the general character previously mentioned, with one end of the machine shown broken away for convenience of illustration.

Fig. 2 is a plan of certain portions of said machine.

Fig. 3 is a perspective of one form of blank to be made on said machine.

Fig. 4 is a perspective of a different form of blank to be made on said machine.

Fig. 5 is a perspective of one of the previously cleated sheets or sections employed in the manufacture of blanks in accordance with the invention.

Fig. 6 is a perspective of one of the cleatless sheets or sections employed in the manufacture of blanks on said machine.

Fig. 7 is a perspective of one of the cleats employed in the manufacture of blanks by the improved method or process.

[fol. 1918] As thus illustrated, the machine shown comprises a body frame 1 having parallel and longitudinally extending guides 2 for the cleats of the blanks. Parallel sprocket chains or feed belts 3 are employed, in the usual manner, these being mounted on sprockets 4 at each end of the machine. The said belts are provided with cleat pushers 5 which extend into the guides 2 to push the cleats along therein. It will be understood that these feed belts or sprocket chains are operated intermittently, in any suitable or desired manner, so that the materials are fed intermittently below the stapling mechanism 6, which latter can be of any suitable or desired form also. Anvils 7 are arranged to enter the guides 2, automatically, being pivoted at 8 and controlled by springs 9, so that these anvils will support any cleatless sections of the blanks to clinch the staples on the under surface thereof. Wire 10 is supplied to the stapling mechanism for the production of the staples, and the machine thus shown and described is of a common and well known form, being equipped with four cleat pushers 5 for each and every blank, so that the blanks to be made in the ordinary manner will be of the character shown in Fig. 3 of the drawings. Such a blank comprises the four sections 11, 12, 13 and 14, the sections 12 and 14 having cleats 15, but the sections 11 and 13 being left cleatless, whereby the blank is of a well-known form commonly called on alternate-cleat blank. The binding wires 16 are secured to the blank by the staples 17 and 18, the staples 17 being longer than the staples 18, whereby the staples 17 secure the cleats 15 to the sections 12 and 14. The cleat pushers 5 of the machine are disposed in position to engage the cleats 15, and in addition said machine is provided with sheet spacers 19 for the separation of the sheets, so that spaces will be provided between the edges of the sheets or sections of the blank, thereby to insure correct folding of the blank, when the same is folded into box form. Any cleatless sheets are necessarily supported on the blocks which have the sheet spacers 19 and cleat pushers 5, as shown, these blocks being secured at predetermined intervals to the belts 3, so that underneath support is necessary for only the unattached

cleats, before the cleats reach the staplers. But of course, during the stapling operation the cleats must be supported.

Now for the production of the blank shown in Fig. 4, the same machinery is employed, but in this case the sections 20 and 21 are provided with cleats 22, which are partially secured thereto by staples 23 driven by an ordinary cleating machine. Thus the sections 20 and 21 come to the machine already equipped with cleats, and consequently the machine does not require any cleat pushers for the cleats 22, inasmuch as these cleats are carried by their respective sheets, and are automatically fed or propelled along the guides 2 in the desired manner. Thus for the production of a blank of the kind shown in Fig. 4, which is a full-cleated or eight-cleated blank, the operator or attendant will place loose cleats in position against the cleat pushers 5, and will place sheets thereon, and will then place the two cleated sections 20 and 21 in position. The materials will then go forward below the stapling mechanism, and will have the binding wires 16 secured thereto in the usual manner. The sections 20 and 21 will have more staples than the other sections, inasmuch as the staples 23 are provided in addition to those driven by the box-blank machine itself.

It will be seen that the cleats are preferably of the tongue and groove kind, being tongued and grooved at their ends to fit together nicely when the blank is folded into box form. Thus either form of blank can be made on one and the same machine. It is obvious, of course, that another form of blank can be made by supplying only one previously cleated sheet, so that the blank will have three cleated sheets and one uncleated sheet when finished. In any event however, the invention contemplates a method of manufacturing box blanks whereby the number of cleats on the blanks can be increased or varied without changing the number of the cleat pushers on the feed belts or sprocket chains by which the materials are fed or moved along to receive the staples from the stapling mechanism. The wires, of course, are secured progressively to the blank, and are cut off at their ends in a manner to provide wire ends which can be twisted together to close the box when the blank is folded into box form. It is obvious, of course, that any kind of heads or end walls (not shown) can be employed to close the ends of the box, and it is obvious that these heads or end walls can be secured to the cleats, or some of them, in the usual and well known manner.

As thus shown, the chains or belts 3 travel in the direction indicated by the arrows in Figs. 1 and 2, and the cleats which slide in the guides 2 will push the anvils or clinch blocks 7 out of the way, so that these anvils will only move into operative position when cleatless sheets come along. When blanks of the kind shown in Fig. 3 are produced, the anvils 7 will move under the sections 11 and 13, to clinch the staples 18, and will be pushed automatically out of the way by the cleats of the other sections. Thus the machine may have any su-table or desired number of cleat pushers 5 and [fol. 1919] is not limited to any particular number, for by means of the method or process shown and described different kinds of blanks can be made on the machine without changing the number of cleat pushers thereon. The invention contemplates, therefore, the feeding of loose cleats for one or more sheets of each blank, and the feeding of previously fastened cleats for one or more sheets of each blank, so that the production of each blank involves the use of cleats which must be initially fastened in place by the same staples by which the wires are secured in place, and the use of other cleats which are fastened in place to the sheet material before entering the machine. Thus for any previously cleated sheet or sheets, no cleat pushers are necessary, and the cleat-pusher method co-operates with the pre-cleating method (or cleat pusherless method) to produce a blank having more cleats than are called for by the number of cleat pushers on the machine, or more than would be possible to fasten in place by the box-blank machine itself. As shown, the box-blank machine is operative to fasten cleats on two sections of the blank; but if another section is to be cleated, or if all the sections are to be cleated, it is obvious that the blank machine itself is inoperative to do that, and hence the additional cleats must come to the machine already attached to their respective sheets, if blanks having more than two cleated sections are to be made without changing the structure of the machine. Thus, as stated, the pre-cleating method is combined with and employed to co-operate with the cleat-pusher method to produce blanks having more cleats than can be fastened in place by the blank machine itself, and different kinds of blanks can be made, depending upon circumstances and requirements and the use to be made of the boxes. All of the sheets, whether cleated or uncleated, are spaced apart and carried on the

blocks of the chains or feed belts, so that each sheet is individually propelled by pressure exerted at its rear edge, and there is no crowding together of the sheets and no communication of feeding or propelling motion from one sheet to another. Consequently, the back pull exerted by the binding wires, as the blanks move along below the stapling mechanism, is communicated successively to the different sheets, and from each sheet directly to the feed belts, so that compression of the sheets together is avoided, and at the same time the blank machine will serve to staple both unattached and previously attached cleats to their respective sheets. The pre-cleating of sheets can be done by an ordinary cleating machine, or in any suitable manner, and when a full-cleated blank is desired, such as the one shown, the materials will be supplied accordingly, so that some sheets are uncleated and some sheets are cleated, and the cleated sheets will alternate with the uncleated sheets on the machine, with loose unattached cleats below each cleatless sheet, before the cleats are all secured in place by the staples which are driven cross-wise of the binding wires to secure the wires to the sheets and cleats to form blanks which can be folded into box form.

Thus a partially cleated blank having one or more cleatless sections can be made on a machine designed for that purpose, and by using previously attached cleats and unattached cleats, as explained, a full cleated blank, or at least one having more cleats than is contemplated by the feeding apparatus, can be made on a machine designed primarily for the making of a blank having one or more cleatless sections. Thus the method contemplates the use of loose cleats and previously attached cleats in the wiring of one and the same blank.

Thus it will be seen that in the practice of the method shown and described, whereby either a cleated or a partially cleated blank may be made on one and the same machine, no spacer blocks are necessary between the cleats, as the pusher system is employed instead, even when precleating is used for one or more of the sheets. The pushers 5 push any loose cleats which are placed in the stationary guides, so that any misplacement or disarrangement of the cleats is unavoidable and automatically rectified, as the loose cleats cannot move forward under the staplers, of course, except as the pushers 5 are in firm engagement with

the rear ends of such cleats; but any previously attached cleats, for precleated sheets, are not capable of any misplacement or disarrangement in the blank machine, as they are properly placed on the sheets before entering the machine, and the precleated sheets push and carry their allotted cleats forward in the stationary guides, so that the pusher system is employed for the cleats in the making of either type of blank. Of course, the spacer system is employed for the sheets, as spacers 19 are interposed between the cleats for precleated sheets. These sheet spacers have three functions, first to space the sheets, second to propel the sheets forward, against any drag or back pull of the binding wires, and third to propel the cleats of any precleated sheets. Thus the cleats do not ride on a moving structure of any kind, but to the contrary are pushed and caused to slide in stationary guides so that misplacement or disarrangement of any loose cleats is necessarily automatically rectified as the result of retardation of the cleats by the guides or other elements with which they come in contact, or by which they are opposed, ensuring firm contact of the rear ends of such cleats with their allotted [fol. 1920] pushers while passing under the staplers, and thus ensuring automatic rectification of any misplacement or disarrangement of loose cleats, and obviating the necessity of using spacers between the cleats to initially position the cleats before placing them in the blank stapling and wiring machine. Frictional retardation, therefore, is employed to automatically rectify any misplacement or disarrangement of loose cleats, relatively to previously attached cleats, thus obviating the use of the spacer blocks between any of the cleats.

What I claim as my invention is:

1. A method of making wire-bound box blanks by securing sheets and cleats and binding wires together by machinery, comprising the feeding of loose or unattached cleats under one or more sheets of each blank, and the feeding of previously attached cleats under one or more sheets of each blank thereby causing the sheet material to initially position some cleats in each blank, while requiring individual positioning of other cleats, so that for each blank there are some previously attached cleats which are carried along by the sheet material, and also some unattached cleats to

be secured to one or more sheets by the machinery for making the blanks, maintaining the sheets and cleats in relative position while moving along, inserting staples to secure binding wires in place to flexibly connect the sections of the blank together and to secure both the attached and the unattached cleats to their respective sheets, so that some cleats are propelled by individual pressure on their rear ends, while other cleats are necessarily propelled by the sheet material.

2. A method as specified in claim 1, in which cleat pushers form the means for maintaining the unattached cleats in relative position.

3. A method as specified in claim 1, in which the means for maintaining the sheets in position prevent the sheets from jamming together at their edges and form the means by which propelling motion is individually communicated to each sheet at the rear edge thereof, so that the back pull of the bindnig wires is sustained by each sheet individually, regardless of whether such back pull is being exerted on a previously cleated sheet or a sheet to which the cleats are being initially attached by the stapling of the binding wires thereto.

4. In the manufacture of wire bound box blanks by machinery having both sheet feeding means and cleat feeding means, a method of making blanks having more cleats than said cleat feeding means is operative to feed, comprising the placing of one or more previously cleated sheets in position for the blank, so that some cleats are attached prior to the wiring operation, placing some unattached cleats in position relatively to the previously attached cleats, placing one or more sheets on unattached cleats, the sheet feeding means spacing the sheets apart, exerting pressure on the rear edges of the sheets, causing the precleated sheet or sheets to propel the cleats thereof, exerting pressure against the rear ends of unattached cleats to propel them in unison with the sheets and other cleats, and stapling binding wires to the sheets and cleats to flexibly connect together the different sections of the blank.

5. In the manufacture of wire-bound box blanks by machinery having both sheet feeding means and cleat feeding

means, a method of making blanks having more cleats than said cleat feeding means is operative to feed, comprising the placing of one or more previously cleated sheets in position for the blank, so that some cleats are attached prior to the wiring operation, placing one or more cleatless sheets in proper position for the blank, placing unattached cleats in position to be attached to said cleatless sheets, the sheet feeding means spacing the sheets apart, exerting pressure on the rear edges of the precleated sheets to cause the same to propel the cleats thereof, exerting pressure against said cleatless sheets and said unattached cleats to propel them in unison with the precleated sheets, and stapling binding wires to the sheets and cleats to flexibly connect together the different sections of the blank.

6. The improved method of manufacture of wire-bound box blanks comprising placing in position one or more precleated sheets, placing in position one or more unattached cleats, placing a sheet or sheets in position over said unattached cleats, exerting feeding pressure on the rear of said unattached cleats and at the rear of said sheets, whereby the assembly material is fed forward and the use of spacer blocks between the cleats and the exertion of back pressure on the front ends of the cleats are obviated.

7. A method of making wire bound box blanks by securing cleats and binding wires together by machinery, comprising the feeding of loose or unattached cleats under one or more sheets of each blank and the feeding of previously cleated sheets for the other sheets of each blank, so that for each blank there are some previously attached cleats which are carried along by the sheet material and also some unattached cleats which are to be secured to their sheets, spacing and maintaining said sheets apart during the feeding thereof to prevent jamming of their edges together, propelling each sheet individually by pressure communicated thereto at the rear edge thereof, so that the back pull of [fols. 1921-1922] the binding wires is sustained by each sheet individually, regardless of whether such back pull is being exerted on a previously cleated sheet or on a sheet initially to be attached to the cleats by the binding wires, and applying binding wires to the cleats and sheets as they are fed.

DEFENDANT'S EXHIBIT NO. 19.

1924

Dec. 15, 1925. 1,565,909

E. CRAIG

MACHINERY AND METHOD FOR MAKING BOX BLANKS

Filed Aug. 3, 1925 4 Sheets-Sheet

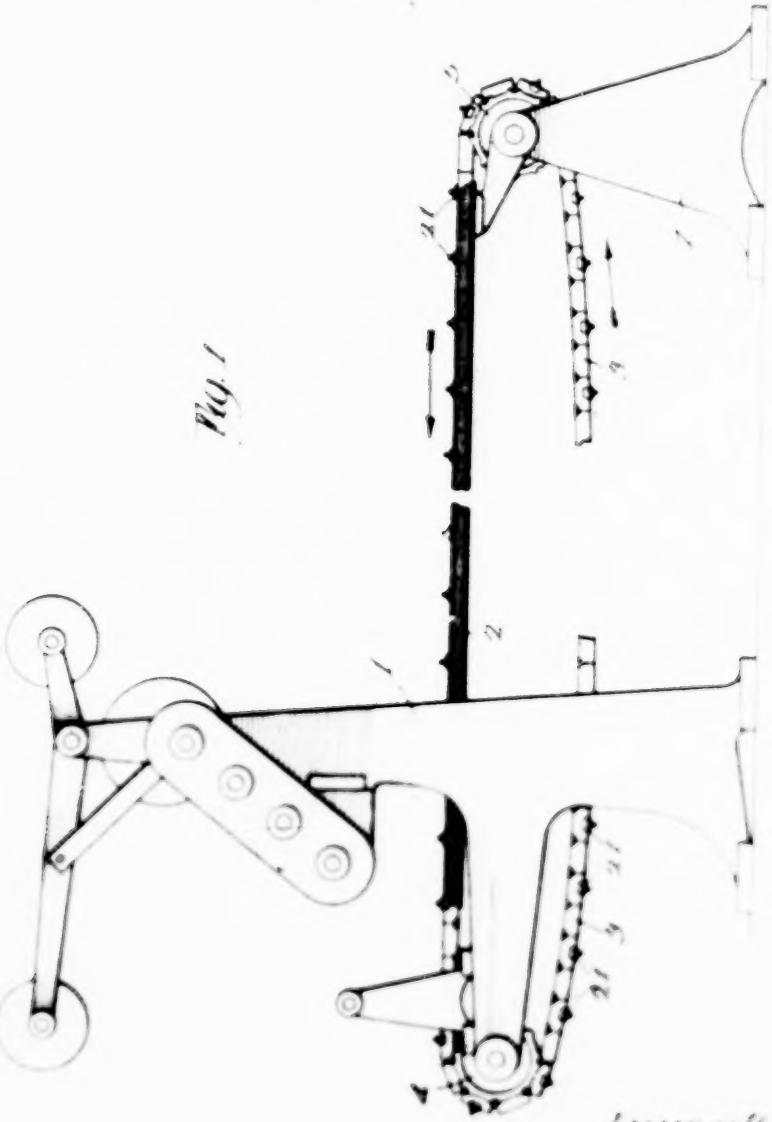


Fig. 1

Inventor
Edward Craig
By Austin & Dunn
Atty

Dec. 15, 1925. 1,565,909

E. CRAIG

MACHINERY AND METHOD FOR MAKING BOX BLANKS

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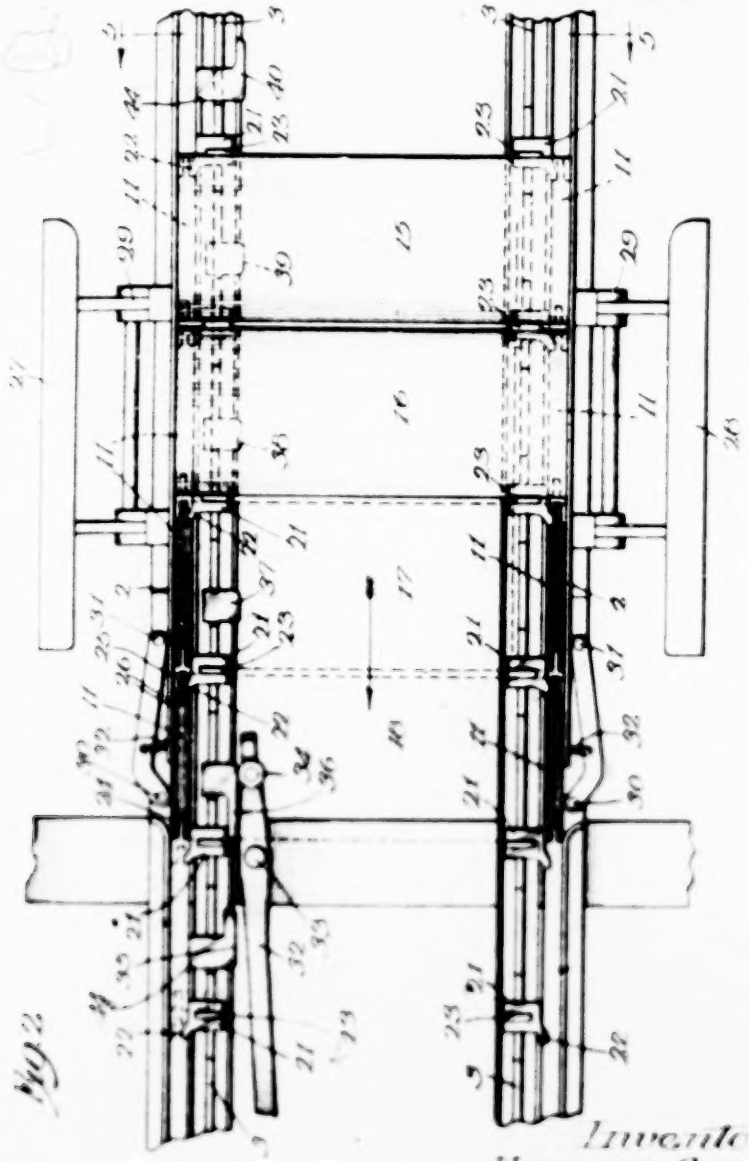

Fig. 2.

Inventor
Edmund Craig
By Arthur A. Durant
Atty

1927-1928

Dec. 15, 1925. 1,565,909

E. CRAIG

MACHINERY AND METHOD FOR MAKING BOX BLANKS

Filed Aug. 3, 1925 4 Sheets-Sheet 3

Fig 3

Fig 4

Fig 5

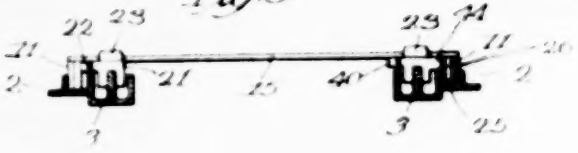

Fig 6

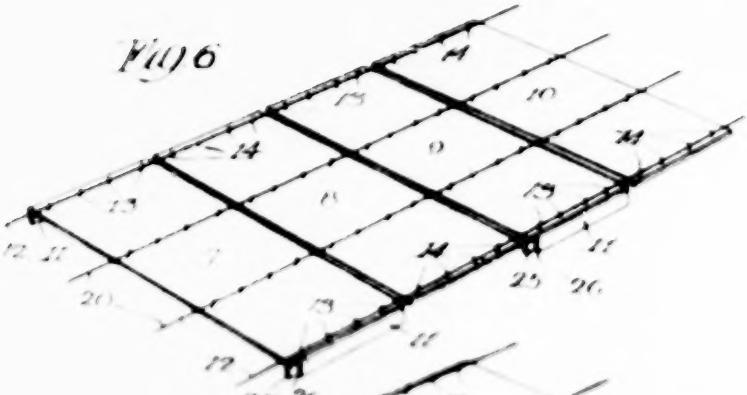

Fig 7

Inventor
Edward Craig
By Arthur A. Fraser
Atty

1929-1930

Dec. 15, 1925. 1,565,909

E. CRAIG

MACHINERY AND METHOD FOR MAKING BOX BLANKS

Filed Aug. 3, 1925 4 Sheets-Sheet 4

Fig. 6.

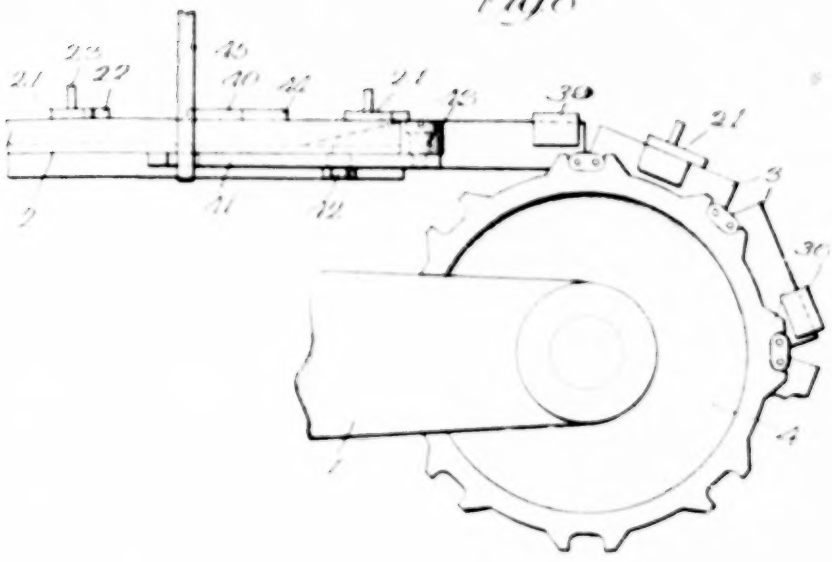

Fig. 7.

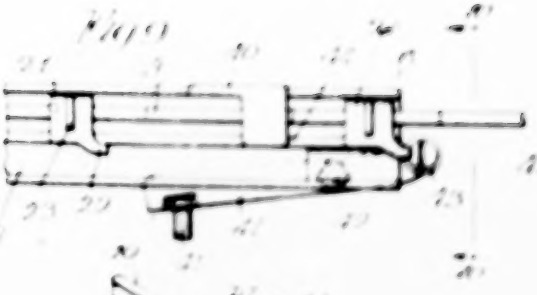

Fig. 8.

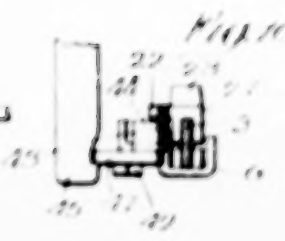

Fig. 9.

Inventor:
Edward Craig
By William F. Ramsey
Atty

blanks, comprising the assembling of precleated and uncleated sheets having cleats therebeneath, individually propelling said sheets and the unattached cleats, and applying binding wires to the sheets and cleats as they are so propelled.

Edward Craig.

(Here follow side folios 1922-1930.)

[fol. 1931] Patented Dec. 15, 1925. 1,565,909

United States Patent Office

Edward Craig, of St. Joseph, Michigan, Assignor to Saranac Automatic Machine Corporation, of Benton Harbor, Michigan, a Corporation of Delaware.

Machinery and Method for Making Box Blanks

Application Filed August 3, 1923. Serial No. 47,746

To all whom it may concern:

Be it known that I, Edward Craig, a citizen of the United States, and resident of St. Joseph, Berrien County, Michigan, have invented a certain new and useful Improvement in Machinery and Methods for Making Box Blanks, of which the following is a specification.

This invention relates to the manufacture of wire bound boxes and more particularly to the manufacture of the preliminary blanks from which the boxes are made, and more especially to the manufacture of blanks of this kind by machinery.

Generally stated, the object of the invention is to provide a novel construction and arrangement of machinery for making wire bound blanks, and a novel method to be practiced in the manufacture of wire bound box blanks, whereby correct positioning of the parts of the blank will be ensured, with reference to the dimensions of the ultimate box to be derived therefrom, when the blank is folded into box form, and certain other advantages gained, as will hereinafter more fully appear.

It is also an object to provide a novel construction and arrangement, and a method of making box blanks of this kind, whereby to obviate the use of certain things heretofore considered necessary or desirable in the manufacture of wire bound box blanks.

It is also an object to provide certain details and features of construction, and method features or steps, tending to increase the general efficiency and the desirability of an apparatus and a method of this particular character.

To the foregoing and other useful ends, the invention consists in the matters hereinafter set forth and claimed, and shown in the accompanying drawings, in which,—

Fig. 1 is a side elevation of a wire bound box blank making machine, embodying the principle of the invention.

Fig. 2 is a plan of a portion of said machine, showing more particularly the construction and arrangement, and mode of operation, of the work guiding and feeding elements.

Fig. 3 is a perspective of one of the work feeding elements, or combined cleat pushers and sheet spacers.

Fig. 4 is a perspective of one of the cams employed on the feed belt to automatically control other elements.

Fig. 5 is a transverse section on line 5—5 in Fig. 2.

Fig. 6 is a perspective of one of the blanks made on said machine.

Fig. 7 is a perspective of another formed blank made on said machine.

Fig. 8 is an enlarged side view of the delivery end portion of the machine, where the wires are automatically cut to separate the blanks.

Fig. 9 is a view looking down on a portion of the structure of Fig. 8.

Fig. 10 is a transverse section on line 10—10 in Fig. 9.

Fig. 11 is a perspective of one of the cams or controlling elements on the feed chains.

As this illustrated, the invention comprises a body frame 1, of any suitable known or approved form, adapted to support the parallel cleat guides 2 in position longitudinally of the machine, to guide the cleats under the staplers (not shown), located in their usual position between the two sides of the upper portion of the body frame, so

that the blanks will pass under and be stapled and wired in the required manner.

The endless link belts 3 are mounted on sprockets 4 and 5, disposed at opposite ends of the machine, and these link belts preferably travel in channel guides 6 which extend parallel with the cleat guides 2, previously mentioned. Any suitable means can be employed for giving these endless feed belts an intermittent feeding motion, so that the blank materials will remain stationary while the staples are driven, and whereby the blank materials will move forward between successive staple driving operations, thereby to drive the staples in the desired manner.

Fig. 6 shows a 4-cleated blank of the kind that may be made on the machine shown and described, the side sections 7, 8, 9 and 10 being separate, the sections 7 and 9 having cleats 11 at each side edge of the blank, so that the first section 7 has 2 cleats, while the section 8 is without cleats, and the section 9 has cleats, but the section 10 has no cleats. Wires 12 are stapled by the machine to the blank materials, the staples 13 straddling the wires and extending through the sheets and into the cleats, while the staples 14 of the [fol. 1062] cleatless sheets are clinched on the under sides of these sheets.

Fig. 7 shows an 8-cleated blank made on the machine shown and described, each of the sheets 15, 16, 17 and 18 having cleats 11, like those previously shown and described. In this 8-cleated blank, all of the staples 19 straddle the wires and extend through the sheets into the cleats. In either form of blank, other wires 20 can be fastened to the blank, if the box is large, to provide additional wire binding between the ends of the box, to render it strong and serviceable in use.

Now, as shown in Fig. 2, and assuming that an 8-cleated blank is to be made, the cleats 11 thereof are placed in the guides, as shown, and sheets 15, 16, 17 and 18 are placed thereon, in the manner shown. The feed chains, previously mentioned, have combined cleat pushers and sheet spacer blocks 21 of the kind shown in Fig. 2, having cleat pusher fingers 22 and sheet spacer lugs 23, substantially as shown. The cleats, as shown, are of the tongue groove

kind, having grooves 24 at their front ends, and tongues 25 at their rear ends, so that shoulders 26 are formed at opposite sides of the base of each tongue, in the manner shown. The cleat pusher fingers 22 are shaped to engage the shoulders 26 on the inner sides of the cleats, as shown, to push them along the guides. The sheet spacers 23 extend upwardly between the edges of the sheets, to space the latter apart, and to push the sheets forward against any drag or back pull of the binding wires, and against any friction of any elements of the machine which may frictionally engage the sheets while they are traveling forward. To hold the sheets down in place, to prevent them from being displaced upwardly, sled runner members 27 are provided at opposite sides of the machine and hinged at 29, thereby to swing upward and upon the sheets to hold them down in place while feeding forward. Friction of the cleats in the guides will tend to retard their forward movement, to keep their shoulders 26 back against the front ends of the cleat pusher fingers 22, and other retarding means, such as springs (not shown) can be employed to engage the cleats to keep them in firm engagement with their pushers. In addition, the staple clinch blocks or clinchers 30 are pivoted on opposite sides of the machine at 31 to bear against the sides of the cleats, under spring pressure provided by the springs 32, to swing inward under any cleatless sheets, to clinch the staples of such sheets as will hereinafter more fully appear.

Thus, the cleat pushers engage the shoulders 26 of the cleats, and it will be seen that these shoulders determine the dimensional characteristics of the box to a more or less extent, when the blanks are folded. The tongues 24, in other words, might be either longer or shorter, without changing the dimensions of the box, so that it is really the position of the shoulders 26 that determines the distance between two opposite sides of the box, and other dimensional characteristics, when the blank is folded into box form. Therefore, the cleat pushers do not extend in between the adjacent ends of the cleats, but simply have lateral engagements with the cleats, at points between the opposite ends of each cleat, and at points which determine the dimensions of the box to a large extent, in the manner explained. Therefore, the cleat pushers are incapable of

serving as spacers, in any sense whatever, and are pushers, pure and simple, and have only lateral engagement with the cleats, and while the distance between adjacent ends of the cleats might vary more or less, in the manufacture of blanks for boxes of the same dimensions, such variation in the distance between adjacent ends of the cleats would not affect the dimensions of the ultimate box, or in any way interfere with the proper folding of the preliminary blanks to produce such boxes. In other words, the tongued, or grooved ends of the cleats could be either longer or shorter, but this would not affect the dimensions of the ultimate box, as the cleat pushers engage the shoulders 26 on the inner sides of the cleats, instead of the rear ends of the cleats. Hence, certain kinds of inaccuracy in the cutting of the cleats is prevented from interfering with the correct dimensions of the boxes.

In a machine of this kind, it is desirable to employ means for automatically controlling the stapling mechanism, to prevent the driving of staples between blanks, or between sections of the same blank, and for this purpose, among other things, a controller 32 is pivoted at 33 on the frame of the machine, and is provided with a roller 34 for engaging the cam blocks 35, 36, 37, 38, 39 and 40 on one of the endless feed belts, previously mentioned. These cam blocks, it will be seen, are entirely separate from the cleat pusher blocks, so that these cam blocks can be adjusted accurately, in any desired manner, without disturbing the relative arrangement of the sheet spacer blocks. Such adjustment can be employed to satisfactorily regulate the automatic control of the stapling mechanism, which control is also necessary, of course, or desirable, to change from long to short staples, by any suitable known or approved stapling mechanism not shown, when a cleatless section, such as that of the blank shown in Fig. 7, passes under the stapling mechanism. The said cams, therefore, may be shaped and located, in any suitable or desired manner, and, depending upon the particular control desired over the stapling mechanism.

Also, in a machine of this kind, it is desirable to automatically cut the wires at points between blanks, to separate the blanks at about the time they leave the left hand end of the machine shown in Fig. 3 of the drawings. It is

prising sheet spacers adjustable thereon for sheets of different widths, a plurality of separate blocks on said instrumentalities, adjustable independently of said sheet

Western District of Michigan, and was argued by counsel.

assembly to two successive machine processes in separate machines.

If reference were to be had only to the paper art, showing the machines above mentioned, we might, for the purpose of this opinion (although we are not prepared to do so otherwise), assume that the patentees' combination of the old material feeding, wire feeding and stapling mechanism with the old performed cleats, would not involve invention; but in this case there is an undisputed history of the practical art which, in our judgment, makes that conclusion impossible.

About 1891, Henry Stephens began to try to make wire-bound boxes. This was under a machine which Howenstine had built to make the Howenstine patented boxes. This machine was not successful. Later, he employed Uhri and some time was spent experimenting with one of the Uhri machines. After some four years of experimental and unsuccessful work by Stephens, never being able to make the boxes successfully, Mr. Healy came into the business. This was in 1894. Thereafter he was the president, manager and chief stockholder in different companies which endeavored to develop such a machine. After the Uhri and the Knutson and Uhri machines had been experimented with [fol. 1943] and abandoned Healy employed Rosback, an expert mechanic and inventor who had a shop in Chicago; his efforts were continued over several years and he built several successive machines. Eventually they were all discarded as failures and dismantled or thrown out in Rosback's yard. Healy then brought in another expert mechanic,—Flora. He also developed a machine which, in turn, was abandoned. The various machines built by Rosback and Flora were patented by the patents shown in the record and became the property of Healy's company. (Flora was 775,622—1904—see record Gibbons case.) All this work upon the Uhri, Rosback and Flora machines had been with reference to the bent veneer type of box; the four sides were made of one continuous sheet of veneer which would bend around the corners and the bending might be aided by cutting the sheet part way through. This type of box was useful and was approved in many trials, but it could not be made at a profit and in competition with the

ordinary wood box, unless it could be turned out by automatic machinery. All these machines over all these years were of the Rosback type,—that is, so far as they accomplished this purpose at all, they used a single rigid four length cleat until the side material was attached, and then severed the cleats. At about this time, in another effort to succeed, Rosback was again employed by Healy, resurrected some of the machines from his yard, brought them to the shop doing Healy's work and spent some months with them. This also failed, the mitering and stapling machines were junked and the blank machine dismantled. Up to this stage, in 1904, Mr. Healy, since he came in, had spent ten years of his efforts and $62,000 of his money (as well as whatever capital others had furnished), and no machine had ever been able to run for a day in such a way as to make boxes that could be sold at a profit. A few hundred boxes of this type had been made and sold, but they had been "tinkered by hand" after they came from the machine,—the machine product itself being too imperfect. Mr. Healy's total return had been $42.31; and the failure of all these machines and patents was demonstrated,—unless vital changes and improvements could be made. Early in [fol. 1944] 1904, Mr. Healy interested Inwood, who came to the plant and undertook to make the machine practical. Inwood associated Lavenberg with him. The contract relations between Healy and Inwood are not now important. Healy still believed that there was a great field open and that he could control it through some of the claims of the existing patents, plus the necessary improvements. Inwood and Lavenberg devised certain betterments and, in May, 1904, placed a machine shop order for a new machine of the Rosback type. They still contemplated the single rigid cleat, to be severed by a second and separate operation. In this connection, they both testified,—and the testimony is not only undisputed but considerably confirmed,—that they observed that certain difficulties could be avoided by using the old preformed cleats, but they concluded that an attempt to do so would bring greater difficulties than benefits into the manufacture and that it was impracticable. They therefore adhered to the old form. A few weeks later, the idea that the preformed cleats could be temporarily assem-

bled and held in a former while the permanent fastenings were applied occurred to them. They developed this idea by drawings into a definite form. They became satisfied that it was practicable, and in June directed the machine shop to make changes in the existing order and to construct the necessary preliminary workholder. The machine was completed and delivered in October, 1904, was found to work successfully, and patents were at once applied for. The commercial growth then began. By 1908, the output was two million boxes, four million in 1909 and six millions in 1910.

Seldom does a record show such a demonstration of the practical value of what seems like a simple change. The preformed cleats were there, various workholders for temporary assembly were familiar to all mechanics, and these things had been at hand all this time; yet during ten years of effort by capitalists and inventors and, the expenditure of large amounts of money, Stephens, Uhri, Rosback and Flora,[3] and indeed for a time Inwood, had not seen what [fol. 1945] is now said to have been always obvious. Their conduct is far more convincing than the present opinion of some expert, who thinks that he would not have been so stupid.

It is not a new simile to say that the progress of an art is travel along a road. When Rosback, Uhri, et al., as road builders, saw that an automatic machine was the point they must reach, familiar preformed cleats, in connection with some temporary assembling means, presented the direct road to that terminal, and to take that road must have been the first though of every traveller but they all believed that this direct road was so obstructed as to make passage impracticable, and so they undertook a troublesome detour, which they never did succeed in opening and improving. The public would not travel, and the whole road remained unused. For ten years the builders tried

[3] In 1904, just before and even after Inwood was brought in, Healy spent $1,200 building Flora's solution of the trouble. Flora adhered to the single long cleat idea, but discarded even the one "pusher," using instead opposite feed rollers.

to develop their detour, to make it a good road, but failed. Then these patentees found an effective though simple means of overcoming the obstacle, opened the direct road, and the detour was abandoned. It would be a bold critic who would say that all the older builders were incompetent, because the way to clear the road had always been obvious.

The practical advantages of the change were that the cleats could be performed in quantities and very cheaply; that short and otherwise waste pieces could be used; that the second operation for mitering the cleats, with all its time and expense, was avoided; that other union forms than miters could be used (as, mortise and tenon); and that the inventors also avoided one of the chief troubles of the old machines, viz., that in step-mitering the ends from the solid cleat and in partially slitting the continuous sheet, the knives were continually cutting through the sheet in spots and cutting into the wires, injuring the product and dulling the knives. There was a saving of 75% in the cost of the lumber for the cleats, and this, with the savings in time, labor and repairs, created a large and successful business out of what had been for ten years a failing struggle. We are convinced that the advance step taken by these patentees came well over into the field of patentability, as defined in the leading cases, too familiar for exhaustive citation, and as applied to a new association [fol. 1946] of old elements leading to a new result. See e. g., Barbed Wire case, 143 U. S. 283; Collar Button case, 148 U. S. 560; Grant Tire case, 220 U. S. 428; Flatation case, 242 U. S. 261; Walker on Patents, 6th Ed., Sec. 63.

What impresses us as the most serious challenge to patentability is the claim that when the patent is tested by applying it to defendant's machine and giving it the construction necessary to make out an infringement, we see that all the patentees did was to take the Rosback machine and "add some extra pushers." By this is meant that the Rosback machine used two parallel conveyor chains; that each of these chains carried a projection or lug which rested against the rear end of the long unsevered cleat and so pushed the cleats and the attached side material through the machine; and that in defendant's final form of machine it has used these chains and these pushers and in addition has only inserted in the chain,

in selected locations, adjustable blocks which project up between the ends of the preformed cleats, whereby each block serves to push the cleat which is immediately ahead of it. If this statement about "adding some extra push ers" were correct and were the whole truth, it would be unanswerable; but we think it neither exact nor complete. The pusher of Rosback was a pusher and holding one; it had no relation to positioning the cleats. The cleats did not have to be positioned in any such secondary way; it was positioned with reference to the stapler by moving the chains. The defendant's machine uses no such sole use of these devices which counsel now call pushers. They are all movable upon the chains for positioning purposes. The rear one, while it pushes the rear cleat rightly with reference to the stapling which is to follow, may be said to have, directly or indirectly, a pushing function exercised upon all of the parts ahead of it. The next three of these devices have no necessary pushing function. The same pushing of all the cleats through the machine would follow if these three were of proper spacing size but had no connection with the travelling chain to get, were dropped in from above. They are primarily positioners; such pushing function as they have is incidental to their [fol 1947] positioning function upon the travelling chain and is not necessarily inherent; they are essential to the positioning, but the pushing could be done in a variety of ways. If the device is altered to adjust it to a box of wider or narrower sides, all these devices except the first are changed accordingly. They firmly hold the cleats, as against any backward tendency, in their proper place relation to each other. They pertain to and develop the thought of the inventors that the preformed cleats can be assembled and held in position during the stapling operation. They would be an excrescence upon the Rosback thought of a single long cleat. When, in the Rosback machine, the four cleats later came into existence by severing, they were already positioned by the wire stapling, and the pushing operation had been finished. We can now see that at any time during their long efforts, Rosback, et al., might have used the preformed cleats and assembled them upon the chains by these pushing, spacing and holding blocks; but the art stood stationary all these years,

while no one saw this solution. To put on "some more pushers" and utilize them as positioners of preformed cleats, was very simple after these inventors had pointed the way, but that is not persuasive; and, as we later point out, defendant has also added holdbacks, as well as pushers.

In reaching the conclusion of patentability, and giving reasonable force to the public acceptance and the creation of a new industry, we do not overlook the doubtless substantial part which another patent played in the commercial result. This was the so-called product patent of September, 1905, covering a blank for a box with overlapping edges, which could be constructed by this machine when including certain details. Until after the time when the machine invention was broadly complete and the order for its construction had been given, these patentees, like all who preceded them, had been planning for the manufacture of a box having for its side material a continuous sheet of veneer, which at the folded corners would turn at right angles with a bend, which might be accelerated by partial slitting; but later, they observed that the machine could be used to produce a box blank with four en- [fol. 1948] tirely separate sides,[1] and that when it was so used they could so space the sides and cleats that when the blank was folded the edges would overlap, with one edge flush with the adjacent side, according to the universal practice in building wooden boxes. The specification of the machine application shows that it might or might not produce this result.[2] At the same time came the application for a patent upon his specific product,—that is, a box blank which would be built by this machine provided it was arranged for separate sheets with overlapping edges in-

[1] It would seem that with bevelled cleat ends a lap corner is impossible unless the cleats are at unequal distances from the side edges; while with step mitered ends, the lap corner is inevitable.

[2] It shows both the continuous sheet sides and the four separate sides, as alternative. It does not mention the lap corner, nor clearly disclose an adjustment particularly adapted to the result.

stead, of a continuous side. This box application went through without difficulty, and the patent was issued in 1906, reissued in 1907, and expiring in 1922. It was sustained in various litigations. Undoubtedly, for most purposes, this overlapping edge box was an improvement over the continuous side box. The public favor which has been mentioned was doubtless due, in some measure, to the overlapping edge feature. Non constat that the older form would not have been accepted on the market with favor. It is clear that the overlapping edge box could not have been a market success unless it had been the product of an automatic machine, which enabled it to be made cheaply. To give the credit for success to the preferred form of the product and to ignore the means of its manufacture, which means alone made the success possible, is an inference which we cannot reach. Perhaps the credit should be divided; enough remains to be persuasive of invention in the machine.

It has been suggested that the disclosure made by the method patent left no room for invention in the machine patent. This suggestion cannot be of force, since the patents were copending and one is not prior art as against the other, even if they had not both been issued on the same day. (See cases infra.) If by the suggestion it is meant that the primary thought was in the method and that little or no invention was needed to make a machine, once the [fol. 1949] method had been conceived, that may be true; but that cannot militate against the validity of the machine patent when the two are practically simultaneous, for in such case, the concept involved in the method is an important and perhaps a vital part of the machine invention. The concept which underlies and precedes the machine may or may not involve an independently patentable method, in either event alike the machine is patentable.

Nor can the product patent invalidate the machine patent as double patenting or by any analogy to that theory. The monopolies granted by the two patents were not coextensive.* The machine patent pertains to assembling

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* A typical claim of the product patent is: "A wirebound foldable box blank, comprising a plurality of straight edged sheets, wires secured to and connecting said sheets,

preformed cleats and holding them in proper relationship while side material and binding wire are attached,—and this, no matter whether the side material is a continuous sheet to be folded or slit, or both, or is a plurality of separate sheets or boards, whose edges overlap, or boards which do not overlap but leave either an edge contact corner or a slightly open corner, or is boards or sheets or slats which do not come near the corner but produce a crate,—all these forms can be made on the machine,—most of them have been, in substantial quantities. In other words, this patent pertains to cleat treatment. The product patent pertains to the selection and treatment of side material, and it covers and protects only one of the several forms of product of the machine. Plainly, the machine invention was the underlying thing, quasi generic; the product patent is a side issue, quasi specific. Even with patents relatively and completely generic and specific, the rule is established, at least in this Circuit, that the generic patent earlier applied for will be neither invalidated nor limited by the specific patent later applied for and copending, even though the later application develops into the earlier issue. Much less will there be such avoidance or limitation, when the two patents are so far from [fol. 1950] coextensive that either one may be infringed without infringing the other.

To consider more generally and carefully the effect upon a later issued patent (as for the machine) of an earlier issued, simultaneously applied for and copending, patent (as for the product): Clearly if the monopolies granted in the two patents are identical, they would cover more than 17 years and there would be double patenting and the latter would be invalid. Even when they are not identical but the small field of the earlier (or later) is included in the larger field of the later (or earlier) there is, as to this small field, a double grant and a monopoly extension,—practically, though not in form. Here are to be classified

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and cleats secured to said sheets, to terminate short of edges of the latter a distance equal to the thickness of a sheet whereby, when folded at a right-angle, the end of one sheet overlaps the end of an adjacent sheet." Compare with claim of machine patent, infra.

patents relatively generic and specific, as well as those machine, process and product patents which overlap each another, but in part only. It has been thought that in the cases thus classified the later patent is invalid, at least to the extent that the monopoly is extended. Language is to be found in Miller v. Eagle, 151 U. S. 186, which may be claimed to support this conclusion, for, from the facts stated, it could be argued that the earlier patent was specific, the later, generic, but the court did not so regard them, and no such construction of Miller v. Eagle is now open to us. As early as the second Judson case (41 Fed. 213, 1890), Judge Coxe had pointed out that, though one patent may seem to have a broad claim and another a specific claim based on the same disclosure, yet analysis may show that there is really no such difference but the scope of each is the same; hence, one is invalid. That is the very principle developed and applied by Mr. Justice Jackson in Miller v. Eagle. Accordingly it was held in the New York Thompson Co. Ohio Co. Case (71 Fed. 712, C. C. A. 2, Wallace, C. J.), that where there are generic and specific inventions in the same structure, they may, at the option of the patentee, be secured by separate patents, and both are valid. Judge Wallace says (p. 466):

"Some observations in Miller v. Mfg. Co. [Eagle] seem to have created some misapprehension of the scope of that decision on the part of the profession, but the principles enunciated in the opinion are so plainly stated that those observations, when considered in their application to the [fol. 1951] case before the court, ought not to be misconceived. The court decided in that case that the two patents to Wright were in fact for the same invention and consequently the later patent was void."

In the Ohio case of the same title which reached this court and was reported in 80 Fed. 712, p. 727-8, the present Chief Justice, speaking for this court, said:

"The case upon which counsel for defendant chiefly relies to support his argument is Miller v. Mfg. Co. [Eagle], where it was held that when two patents were issued to the same patentee for the same invention the second patent was void for the reason that the new or later patent would prolong the monopoly beyond the period

"[the inventor's] is the option to secure all these inventions by a single patent, or by many patents, and the fact that he describes all of them in his application or specification for an earlier patent to secure one or more of them, does not invalidate a subsequent patent to him for those inventions there described but not claimed. * * * **The sum of the whole matter is that while an earlier patent avoids a later patent to the same patentee for the invention claimed and secured by the former, it does not invalidate a later patent to him for a distinct, different and separate invention, whether specific or generic, whether an original machine or process, or both, or an improvement thereon, which is not actually claimed by the earlier patent.**"

patenting unless the claims are
[illegible] see Walker, 6th Ed., Sec.
[illegible] is cited to the
[illegible] patent will invalidate
[illegible] for the process by which
[illegible] page 361 is repe-
[illegible] The subject matter of the patents was
[illegible] for use in making safe frames. There
[illegible] for the formed angle bar, but by
[illegible] and the patent for the process of
[illegible] to produce the patented form. The
[illegible] that the product was not patent-
[illegible] that, if this were true, there
[illegible] in the process that the
[illegible] as to both patents without
[illegible] for holding the process patent
[illegible] Supreme Court approved and adopted the
[illegible] and then added justification for the
[illegible] process patent. It is not entirely clear upon
[illegible] this result is intended to be placed.
[illegible] that the method was purely mechanical; but
[illegible] might not to be taken as the basis of the re-
[illegible] for, if so, it would be overruled in Expanded Co. v.
[illegible] 274 U. S. 236. Nor can it be thought that the re-
[illegible] upon the fact that the process had been dis-
[illegible] in the earlier filed product application, for then the
[illegible] would be in conflict with the now unquestioned rule
[illegible] among copending applications by the same inventor
[illegible] is not prior art as against another. The case must
[illegible] we think, depend upon its conclusion that the
product and the method patents were not for two inven-
tions, but for one. So construed, the opinion is consistent
with the application of the settled principles which have
been referred to; otherwise construed, it is not. Indeed, it
is unclear upon analysis of the two patents, that the method
could produce only the patented result and that the pat-
ented result could be produced only by the method, that the
Patent Office, under the practice as now clarified, would
not permit separate patents. The Mosler case therefore is
not pertinent where the use of the claimed machine may or
may not result in the patented product, and where the

claimed product can be made otherwise than by the patented machine. The machine will make the patented lap corner blank, or the unpatented open corner blank, continuous side blank or crate blank. The patented product can be made by this machine, or wholly by hand, or by the Rosback machines, or by hand feeding to a stapling machine.

As noted above, it may occasioally happen, as it did here, that the specific patent is so appealing in its specific features that it gets a practical market monopoly of the subject matter, and that the generic patent of longer term will extend that practical monopoly; but if this is an evil,—sometimes it may be and sometimes not,—the remedy is with Congress, not with the courts. Clearly, during all the interval between the machine invention in 1904 and the issue of the patent thereon in 1915, the public had unrestricted right to use the machine, excepting to make the overlapping edge box, and, since the expiration of that product patent in 1922, the public has had the unrestricted right to make that box, by any machine or method except the patented one.

[fol. 1955.] It seems to us entirely plain that the product patent must be immaterial as to the validity of the machine patent, unless the former was prior art or the latter was double patenting; and equally plain that neither condition exists.

Nor should there be any confusion or prejudice on account of the long delay of this machine patent in the Patent Office. After two years of diligent prosecution (in which the delay was mostly by the Patent Office), it went into interference with Brown, and this interference went through its due course before all the Patent Office tribunals. It is not suggested that there was any substantial delay for which the patentees were responsible. The final decision in their favor by the Court of Appeals of the District was in 1912. The further prosecution thereafter to issue was in ordinary form and was at least reasonably diligent,—if not unusually so. Here again, the delays resulting from interference or other adversary proceedings in the Patent Office, present an evil which can be remedied only by Congress. Patentees cannot be penalized for submitting to delay which they cannot avoid, nor are they under any obligation to be more diligent than the statute and rules require. (U. S. v. American Bell, 167 U. S. 224.)

We come now to the matter of infringement: We take as typical of the claims sued upon No. 25, which reads as follows:

"A machine for making box blanks comprising: Work controlling means having cleat positioning means to receive sectional cleats in parallel lines, and spacing means to space cleats endwise from each other in each line, preparatory to connecting said cleats in their spaced relation, said work controlling means being arranged to receive side material to be secured to said cleats; fastener applying means for securing binding means to the side material and cleats controlled by the work controlling means; means for relatively feeding the work controlling means and fastener applying mechanism for securing said binding means across the intervals between said spaced cleats to secure them together in their spaced relations to form a foldable blank."

[fol. 1956] The mechanical difference between the form shown in the patent drawings and defendant's third form, is that the patentees assembled their cleats and positioned them in the workholder, which was independent of the moving conveyor, and then put the holder on the conveyer to be moved along.[1] In substance this workholder consists on each of four pockets, in each of which a cleat fits closely enough to be held in true position while the cleat and overlying side material are passed under the stapler. The defendant has united its workholder and conveyer into one structure. It does this by attaching to the conveyer chain, at selected spots, five upstanding and outstanding blocks. The conveyer chain runs between side channel walls, which correspond to the sides of the patented workholder. These blocks therefore divide that channel space into four pockets, each of which holds and positions its cleat, as it and the side material are advanced under the stapler. If we place side by side plaintiff's workholder upon its conveyor and defendant's conveyer with its four pockets thus formed, each just before passing under the stapler, we see no substantial distinction in form or in operation, and only one distinction which merits notice. This is, that in the pat-

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[1] In specific form, their conveying means was a pinion-driven rack, on which the workholder rested.

ented machine the dividing partitions positively position the cleats in both directions,—that is, each partition bears against the cleat behind it as well as the one ahead, while in the defendant's structure the positive contact of the positioner is only with the cleat ahead of it. There is no direct contact between this positioning block and the following cleat. This device is adapted for mortise and tenon joints and the cleats therefore have a side shoulder near the end, and the defendant's positioning block avoids the end of the cleat and reaches out to engage with this side shoulder. Thus there is between the extreme cleat ends a small free space, and hence possible slight forward motion of the cleat in its groove and away from its rear contact. There is practically a forward stop, though by less direct means. The positioning blocks carry upward lugs which act as spacers between the sheets of side material, and all [fol. 1957] four sheets must therefore move forward as a unit. For the cleats to slip forward against what might be made the normal retarding friction on four sides would not be very probable. Further, and as a more direct stop, the defendant's machine carries, as the patent does, means for exerting a spring side pressure against the cleat just as it comes under the stapler. This, in different forms, is called the clincher or the detent. It forces that cleat to exact position laterally and, either by projecting in front of the cleat or by side frictional effect, forces it back against the rear positioning block, and to exact position longitudinally. Thus at the critical moment when the stapling is done, defendant's cleats are positioned as absolutely and as accurately as in the patented form. If the normal retarding friction does not hold the cleat back against the block,—as it may not against the intermittent motion,—such a front detent stop would seem essential. As far as we observe, it was provided in all forms of defendant's machines.

We find nothing either in the state of the art or in the specifications which requires a claim like 25 to be so limited to the use of a pocket which positively confines the cleat in all four directions as not to reach one which confines positively in three directions and sufficiently for all practical purposes in the fourth. In any fair degree of equivalency, the call for "spacing means to space the cleats endwise from each other" is met by the positioning means

which defendant uses. This would be true even if the contemplated spacing were perfected only in each pocket successively, as it arrives at the only spot where perfect spacing is important. Though the patentees' advance step was such that its inventive character was plausibly challenged, yet after its patentability is determined, we see that it was the foundation of a large development in the art, and that it has a relatively pioneer status. Its claims are entitled to a fairly liberal scope.

As to the suggestion that the conveyer chain form of defendant's machine is so different from the patented form that it should not be contemplated as intended to be reached, we may cite a paragraph of the specification which [fol. 1958] is here quoted in the margin.[8] It would almost seem that the draftsman had prevision of the specific form which defendant's infringement was to take, many years later.

The method patent was issued upon a divisional application, filed in 1912, by separating it from one of the mechanical applications. The court below held it invalid for laches, applying what that court understood to be the rule of the Splitdorf Case (264 U. S. 263). This was before we had our Wagenhorst Case (27 Fed. 2nd 27) adopted our interpretation of the Splitdorf decision. Under that interpretation, it is not seen how this delay could be sufficient reason for invalidating the patent. The method was fully

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[8] "We wish it to be understood that this invention is not to be limited to the use of removable carriages or formers such as described, and which are in the nature of adjuncts applicable to the wire feeding and stitching machine. Any means for positioning the separate parts of the blank material in proper relation, as broadly defined in the claims, may be substituted for the formers, or carriages described, whether removable from and replaceable in the machine; or otherwise. In operating the apparatus shown and described, the carriages or formers may be fed into the machine one after the other in a manner to obviate the necessity of stopping the machine after each blank is stitched. In this way, an endless chain of cleat and sheet holders and positioners, with the material thereon, may be caused to pass between the bed-frame and stapling devices, and keep the machine working to its fullest capacity."

disclosed by both mechanical applications. Method claims were added to the machine application within a few days after it was filed. The Patent Office said that these method claims covered only the operation of the machine and were therefore improper. Applicants then cancelled these claims. This was rather plainly a mistake, as the Patent Office later decided when it approved similar claims; but, mistake or not, this action by applicants was of course subject to reconsideration and disavowal by them at any time during the progress of the application, before other rights had intervened. It was an abandonment only until they should change their minds and reclaim. While in that situation, the interferences developed upon both applications. While these were pending it would have been technically possible to file a divisional method application, but this would have been a useless thing, as the decision in the exist- [fol. 1959] ing interferences would decide also who was entitled to method claims, if any one was. After the interferences, the method claims were restored to both applications, and were there maintained while the Patent Office, conceding in effect its former error, held that the claims could be made, but required a divisional application. This was duly made and prosecuted to allowance. No adverse claim was made to the method or to any machine which would involve the method until, at the earliest, two years after the method patent issued. This case is plainly not within the Splitdorf rule, as we understand it, either by parallelism or by strict analogy. Defendant points out, as a general analogy, that the machine and method had been in public use by the applicants, who became the patentees, and under licenses from them, all for more than two years before the divisional application was filed. This is true. When it is remembered that the divisional application is normally entitled to the benefit of the original filing date, it is not easy to see how public use under license from the applicants can amount to that laches under which adverse rights may arise; or how the Splitdorf rule can apply unless the delay is after the public appearance of an adverse claimant,—or, perhaps, one who may be an adverse claimant; but we find it unnecessary to decide that question. It is further apparent (from the claims) that the question of double patenting, as between product and method is not the same as between machine and product; and also that whether this method, if

the claims are construed broadly enough to make them separable from the operation of the machine, involves any patentable invention, is a debatable question; and, if they must be confined to a method which can be practiced only by the machine or its equivalent, again doubt at least arises. Coming to the workholder patent, we meet a similar question. If it is to be construed broadly enough to reach the defendant's structures, and is to be disassociated from its status as an essential part of the machine patent, the presence of patentable invention can be forcefully challenged. We see no occasion for deciding these questions of validity of the method patent and the validity and infringement of the workholder patent. So far as has been pointed out or [fol. 1960] as we observe, there has not been and is not likely to be any commercially important infringement of either of these patents, which does not also infringe the machine patent. They were all issued on the same day and expire at the same time. Questions of accounting, so far as we see, are the same under claim 25 of the machine patent, as we have construed it, as under any other claims of that or the other patents; and while theoretically the right to injunction might be important, we see no indication that it will be of practical value, because other methods would cost too much. In this situation we have frequently declined to enter upon difficult questions which are practically moot. If we misjudge this situation, and our further consideration of the other claims in suit under any patent is reasonably necessary to settle the controversy between these parties in its present or in any probable modified form, counsel may suggest the necessity and we will give it attention.

In the case against Gibbons, involving these three patents and the lap-corner box patent, the District Court in Illinois dismissed the bill without opinion. The Circuit Court of Appeals (25 Fed. [2], 363) affirmed this decree. Appellant's counsel now insists that a reading of the original opinion of that court demonstrates that the court considered the lap corner—later filed and copending—patent as a part of the prior art, supporting its conclusion that the machine invention was not patentable.[9] This analysis by

[9] The court said: "It was the patentees' fundamental difference in the order of assembly and methods of construction that contributed most to their invention over Rosback."

counsel may or may not be correct; but the original opinion and the per curiam upon rehearing together demonstrate that the conclusion of non-invention was finally based upon the undisputed prior art. As we read the opinions, that court thought, as we do, that the substitution by the patentees of the one-machine assembly and treatment of preformed cleats for the Rosback one-cleat, two-machine combination possessed the true inventive character; but it allocated this merit to the lap-corner patent, which turned out to be the popular form of the product resulting from the [fol. 1961] change in the machine. We have indicated our reasons for thinking that the dominating new result, which gave inventive character, is to be found in the new combination of machine elements which permitted the automatic production of any kind of a wirebound box, rather than in the particular form of product box which proved to be the best seller. Convinced as we are that this is the right view, we find ourselves constrained to reach a different conclusion from that adopted in the Seventh Circuit. Of course, this is not to deny that the lap-corner box blank, as patented in its specific form, had specific patentable merit; but even if the box patent was erroneously sustained, that error would not justify another.

Out of the very numerous other points made in appellee's 250 pages of briefs, we find none requiring further discussion.

The decree below will be reversed, with instructions to enter the usual decree for injunction and accounting, based on claim 25 of the machine patent, and to dismiss the bill, without prejudice, as to the method and work-holder patents. The other claims of the machine patent may be ignored in the decree. Appellant has largely succeeded in this appeal, but in large part has not. We award it half costs in this court. Costs below to this time are discretionary in that court. Whether our disposition of them here furnishes analogy helpful as to costs below that court will decide.

UNITED STATES CIRCUIT COURT OF APPEALS

DISSENTING OPINION

KNAPPEN, Circuit Judge, dissenting:

I am unable to agree in the conclusion of the majority opinion, which reverses the decree of the District Court (which found the machine patent—No. 1,128,145—invalid if infringed by defendant), and directs decree for injunction and accounting based on that patent, and dismissal of the bill without prejudice as to the method and work-holder patents.

I am constrained to agree with the opinion of the Circuit Court of Appeals of the Seventh Circuit in the Gibbons case (25 Fed. Rep.—2nd—363 to 366 inclusive), which holds the machine patent (as well as the work-holder and method patents) invalid for lack of invention. The statement of [fol. 1962] reasons and the logic of the Court of Appeals of the Seventh Circuit in finding those patents invalid, both as stated in the original opinion (pp. 364-365) and in the per curiam opinion (pp. 365-366), seem to me convincing.

This makes it unnecessary for me to discuss the art prior to Inwood and Lavenberg, except to say that while in making the boxes by hand, preformed separate sheets and premitered cleats had been used before the patents in suit had been applied for, they were not regarded as practicable for machine manufacture. It remained for Inwood and Lavenberg to discover that the use of such preformed separate sheets and premitered cleats in machine manufacture was practicable. This use of preformed separate sheets and premitered cleats runs all through the four patents. The contrast between the method of manufacturing wirebound boxes under the patent and the then present method is plainly set up in the reissue patent No. 12,275. The drawings of the patent, in connection with the language of the specifications, clearly indicate the process to be employed in making the product of the patent. The claims of the reissue patent seem to me to indicate plainly to one skilled in the art the process to be employed. As concluded in the original opinion of the Circuit Court of Appeals of the Seventh Circuit in the Gibbons case (p. 364): "The entire story

of appellees' invention is told in this reissue patent, and * * * The solutions of the problems demonstrated in the other three patents were obvious and involved the exercise of merely ordinary mechanical skill": and as stated in the per curiam opinion (p. 366): "It [the reissue] was the culmination of their [patentees'] efforts, and therein lies the entire story of their invention, as we have stated in the original opinion." Upon the theory of that opinion, the question of copending application as prior art is not involved. Nor am I impressed that the validity of the machine patent is governed by the rule that generic and specific inventions may, at the option of the patentee, be secured by separate patents. The controlling objection is not that there has been double patenting, but that there is [fol. 1963] lack of invention in the machine patent. As stated by the Circuit Court of Appeals of the Seventh Circuit (25 Fed. [2nd] at p. 366):

"*The moment the long cleat was discarded and supplanted with short ones,*" the workholder and machine readily appeared as the logical solution of the mechanic to the problem confronting him. We cannot believe that in this situation invention was achieved or that anything more than the exercise of mechanical skill was involved. Novelty and utility in the combination did not arrive until further improvement was made, that of preforming the side materials and so arranging them that they would overlap. This last step accomplished an improvement, and the patent for the combination, with this improvement, was by us sustained."

Nor is it important that, as asserted, the work-holder and stapling machine inventions were conceived earlier than the reissue box patent; because previous to the invention of the box patent the other two inventions were wholly impracticable. After that invention they became useful, but only by virtue thereof.

In view of what is above stated as to the validity of the machine patent, the question of validity of the method patent (No. 1,128,252) is perhaps not very important as the issue is developed on this present review. It would seem enough to say that, in my opinion, the method patent is

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* Italics mine.

invalid for the further reason that it is for the process which results in the product which is covered by the reissue patent. Mosler v. Mosler, 127 U. S. 354; Miller v. Eagle Mfg. Co., 151 U. S. 186, 187. Nor does the rule forbidding priority in case of copending applications apply to this defense. Indeed, in Mosler v. Mosler, supra, the applications were copending. The question as presented in the instant case is readily distinguishable from Century Co. v. Westinghouse Co.—C. C. A. 8—191 Fed. 350, 352 et seq. The conclusion that the method patent is invalid for the other reason herein suggested makes it unnecessary to consider the correctness of Judge Raymon's holding that the [fol. 1964] patent is invalid by reason of delay in filing divisional application; nor the effect upon that defense of our decision in Macgregor v. Vaco Grip Co., 2 Fed. Rep. (2nd) 655. Nor is it necessary to consider the question of infringement by appellees as to either patent.

Clerk's certificate to foregoing transcript omitted in printing.

[fol. 1965] SUPREME COURT OF THE UNITED STATES

ORDER ALLOWING CERTIORARI—Filed April 21, 1930

The petition herein for a writ of certiorari to the United States Circuit Court of Appeals for the Sixth Circuit is granted. And it is further ordered that the duly certified copy of the transcript of the proceedings below which accompanied the petition shall be treated as though filed in response to such writ.

Endorsed on cover: File No. 34,806. U. S. Circuit Court of Appeals, Sixth Circuit. Term No. 51. Saranac Automatic Machine Corporation, Petitioner, vs. Wirebounds Patents Company, et al. Petition for writ of certiorari and exhibit thereto. Filed February 20, 1930. File No. 34,806.